Endangered Species Act Section 7 Consultation
Magnuson-Stevens Act Essential Fish Habitat Consultation
Biological Opinion

Lead Agency: National Marine Fisheries Service, NW Region, Protected Resources Division

Activity: Issuance and Funding of 6 Section 10(a)(1)(A) Permits, Permit Modifications, and Permit Amendments for Takes of Endangered Upper Columbia River Spring Chinook Salmon and Endangered Upper Columbia River Steelhead for Scientific Research Purposes

Conducted By: National Marine Fisheries Service, NW Region, Protected Resources Division

Consultation Number: F/NWR/2001/01447

Signature: for D. Robert Lohn **Date Issued:** 8/1/02

Expiration Date: December 31, 2006

This biological opinion constitutes the National Marine Fisheries Service's (NMFS) review of six Endangered Species Act (ESA) section 10(a)(1)(A) permit actions (two applications for new permits, two requests for modifications to permits that are currently active, and two amendments of active permits). It has been prepared in accordance with section 7 of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). It is based on information provided in the applications for the proposed permits and permit modifications, published and unpublished scientific information on the biology and ecology of endangered and threatened salmon and steelhead in the action area, and other sources of information. A complete administrative record for this opinion is on file with the Protected Resources Division, National Marine Fisheries Service in Portland, Oregon.

CONSULTATION HISTORY

On April 10, 1998, NMFS issued a biological opinion on the NMFS action of issuing 19 ESA section 10(a)(1)(A) permits and permit modifications for scientific research and monitoring activities involving endangered upper Columbia River (UCR) steelhead (*Oncorhynchus mykiss*) for the period 1998-2002 (NMFS 1998a). This biological opinion supplements the April 10, 1998 opinion which expires at the end of 2002.

On November 12, 1999, NMFS issued a biological opinion on the NMFS action of issuing 19 ESA section 10(a)(1)(A) permits and permit modifications for scientific research and monitoring activities involving endangered UCR spring chinook salmon (*Oncorhynchus tshawytscha*) for the period 1999-2003 (NMFS 1999c). This biological opinion supplements the November 12, 1999 opinion which expires at the end of 2003.

On July 2, 2001, NMFS issued a biological opinion on the NMFS action of issuing 13 ESA section 10(a)(1)(A) permits and permit modifications for scientific research and enhancement activities involving UCR spring chinook salmon and UCR steelhead for the period 2001-2005 (NMFS 2001b). This biological opinion supplements the July 2, 2001 opinion which expires at the end of 2005.

The proposed actions in this consultation are the issuance of 6 permit actions (2 new permits, 2 permit modifications, and 2 permit amendments) authorizing takes of endangered UCR spring chinook salmon and endangered UCR steelhead associated with scientific research activities. PRD NWR decided to group them in a single consultation pursuant to 50 CFR 402.14(c) because the proposed actions are similar in nature, they involve takes of ESA-listed species found within common or overlapping geographic boundaries, and they may result in effects to those species simultaneously. Because the proposed research activities will affect the same species and be conducted in the same general areas, NMFS intends this opinion to be valid until December 31, 2006, and proposes to issue all new permits with expiration dates of December 31, 2006. If the status of the species change, new information is received, or other circumstances contemplated by the reinitiation provisions arise, NMFS will update this opinion. NMFS also has the ability to modify or suspend permits based on new or different conditions, and can alter take authorizations as needed.

Some of the proposed research activities may affect ESA-listed species under the jurisdiction of the U.S. Fish and Wildlife Service (e.g., threatened bull trout (*Salvelinus confluentus*)). Permit applicants are required to obtain a take authorization from the U.S. Fish and Wildlife Service (USFWS) if ESA-listed species under its jurisdiction are expected to be encountered.

The consultation histories for each of the proposed permit actions are described below:

<u>Permit Modifications/Amendments</u>

Permit 1141, Modification 3– Public Utility District No. 2 of Grant County

The consultation period for Modification 3 to Grant County Public Utility District's (PUD) Permit 1141 began when NMFS published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on April 12, 2002.

Permit 1322, Modification 1– Northwest Fisheries Science Center, NMFS

The consultation period for Modification 1 to Northwest Fisheries Science Center's (NWFSC) Permit 1322 began when NMFS published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on April 12, 2002. A second Notice of Receipt was published in the *Federal Register* on June 11, 2002.

Permit 1335, Amendment– U.S. Forest Service

The consultation period for an amendment of U.S. Forest Service's (USFS) Permit 1335 began when NMFS published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on November 9, 2001. Permit 1335 was issued to USFS on February 21, 2002.

Permit 1345, Amendment– Washington Department of Fish and Wildlife

The consultation period for an amendment of Washington Department of Fish and Wildlife's (WDFW) Permit 1345 began when NMFS published a Notice of Receipt in the *Federal Register* (initiating a 30-day public comment period) on July 25, 2001. Permit 1345 was issued to WDFW on March 8, 2002.

<u>New Permits</u>

Permit 1366– Oregon Cooperative Fish and Wildlife Research Unit

The consultation period for the Oregon Cooperative Fish and Wildlife Research Unit's (OCFWRU) request for a scientific research permit (Permit 1366) began when NMFS published a Notice of Receipt in the *Federal Register* on April 12, 2002.

Permit 1386– Washington Department of Ecology

The consultation period for the Washington Department of Ecology's (WDOE) request for a scientific research permit (Permit 1386) began when NMFS published a Notice of Receipt in the *Federal Register* on June 25, 2002.

DESCRIPTION OF THE PROPOSED ACTIONS

Common Elements Among the Proposed Actions

NMFS proposes to issue, modify, or amend five permits, pursuant to section 10(a)(1)(A) of the ESA. All of the permits would authorize take of endangered, naturally-produced and artificially-propagated,[1] UCR spring chinook salmon and/or endangered, naturally-produced and artificially-propagated, UCR steelhead. Some of the activities identified in the proposed permit actions will be funded by several Federal agencies including NMFS, USFWS, the U.S. Army Corps of Engineers, the Bonneville Power Administration, USFS, the U.S. Geological Survey, and the U.S. Environmental Protection Agency. Although these agencies are also responsible for complying with section 7 of the ESA because they are funding activities that may affect ESA-

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[1] Under NMFS policy, the progeny of hatchery and wild crosses are generally considered listed species for purposes of the ESA (58 FR 17573, April 5, 1993). Artificially-propagated UCR steelhead and UCR spring chinook salmon qualify as listed species under this policy and are therefore considered in the analyses throughout this biological opinion.

listed species or their designated critical habitats, this consultation considers the activities they propose to fund and will fulfill their section 7 consultation requirements.

For the most part, the Applicants for new permits request multi-year permits that will expire on December 31, 2006. One permit for which a modification is requested (Permit 1141) will expire on December 31, 2002. NMFS expects that the holder of that permit will request an extension through December 31, 2006 or apply for a new permit when the existing permit expires. Because the proposed activities will affect the same species and be conducted in the same general areas, NMFS intends that this opinion be valid until December 31, 2006. If the status of any of the species changes, new information is received, or other circumstances contemplated by the reinitiation provisions arise, NMFS will update this consultation. NMFS may also modify or suspend permits based on new or different conditions and can alter take authorizations as needed.

Under section 10(d) of the ESA, NMFS is prohibited from issuing a section 10(a)(1)(A) permit unless NMFS finds that the permit (1) was applied for in good faith; (2) if granted and exercised, will not operate to the disadvantage of the endangered and/or threatened species that is/are the subject of the permit; and (3) is consistent with the purposes and policy of section 2 of the ESA. In addition, NMFS does not issue a section 10(a)(1)(A) permit unless the proposed activities are likely to result in a net benefit to the ESA-listed species that is/are the subject of the permit. Benefits to ESA-listed species accrue from the acquisition of scientific information. For example, juvenile fish trapping efforts have enabled the production of population inventories, passive integrated transponder tagging efforts have increased the knowledge of anadromous fish migration timing and survival, and fish passage studies have provided an enhanced understanding of fish behavior and survival when moving past dams and through reservoirs. By issuing section 10(a)(1)(A) scientific research permits, NMFS will cause information to be acquired that will enhance the ability of resource managers to make more effective and responsible decisions to sustain anadromous salmon and steelhead populations that are at risk of extinction, to mitigate impacts to endangered and threatened salmon and steelhead, and to implement recovery efforts. The resulting data will improve the knowledge of the species' life histories, specific biological requirements, genetic attributes, migration timing, responses to anthropogenic impacts, and survival in the river systems.

In general, Applicants conduct the following types of scientific research and monitoring activities: (1) Physiological testing of fish condition during collection, bypass, and transportation around hydropower dams; (2) determining fish distribution and habitat requirements through juvenile and adult salmonid surveys; (3) monitoring the condition of juvenile salmon and steelhead and investigating the migration timing and requirements of juvenile and adult salmonids; (4) determining adult escapement and juvenile production in tributaries; (5) monitoring adult and juvenile salmon and steelhead passage through dams and reservoirs; (6) determining the efficiency of the juvenile bypass facilities; (7) conducting habitat restoration studies; (8) conducting genetic monitoring studies using tissue or scale samples; (9) determining the status of supplementation efforts and their impact on the recovery of naturally-produced salmon and steelhead; (10) identifying factors contributing to juvenile salmon and steelhead stranding; (11) assessing the prevalence of disease; and (12) determining the biological effects of gas supersaturation. A number of research projects will focus on monitoring and evaluating management actions that are recommended for the recovery of ESA-listed salmon and steelhead populations. In addition, some of the permits that NMFS issues include takes of ESA-listed species associated with enhancement activities such as salvage/rescue operations.

The proposed activities involve harassing (e.g., passive observation by snorkeling or video camera, spawning ground surveys, or delaying adult fish at barriers), capturing, trapping, handling, tagging, marking, holding, transporting, and/or sacrificing ESA-listed salmon and steelhead. Methods of capturing fish include trapping in a weir, trap box, or other containment associated with a fish barrier, seining or netting, and electrofishing. The types of tags and/or marks likely to be used include passive integrated transponders (PIT), radio transmitters, fin clips, cheek tags, and/or balloon tags. Researchers will collect tissues and scale samples from live fish and fish carcasses and those tissues and scale samples will be transferred to a number of designated laboratories for archival and/or analysis.

The permits will include Special Conditions that Permit Holders are required to observe while conducting the activities. These conditions are intended to (a) manage the interaction between scientists and ESA-listed salmonids by requiring that research activities be coordinated among Permit Holders and between Permit Holders and NMFS, (b) require measures to minimize and mitigate the impacts on the target species, (c) require Permit Holders to notify NMFS in the event of excessive or unauthorized takes of ESA-listed species, and (d) require Permit Holders to report to NMFS annually on their activities and the effect that those activities have on the species concerned. The following Special Conditions will be included in the permits unless NMFS determines that a specific condition is not applicable:

1. Each ESA-listed fish handled out-of-water must be anesthetized. Anesthetized fish must be allowed to recover (e.g., in a recovery tank) before being released. Fish that are simply counted must remain in water and do not need to be anesthetized.

2. ESA-listed fish must be handled with extreme care and kept in water to the maximum extent possible during sampling and processing procedures. Adequate circulation and replenishment of water in holding units is required. When using gear that capture a mix of species, ESA-listed fish must be processed first to minimize the duration of handling stress. The transfer of ESA-listed fish must be conducted using a sanctuary net that holds water during transfer, whenever necessary to prevent the added stress of an out-of-water transfer.

3. If any ESA-listed adult fish are captured incidental to sampling for juveniles, they must be released without further handling and such take must be reported.

4. ESA-listed fish must not be handled if the water temperature exceeds 70 degrees Fahrenheit at the capture site. Under these conditions, ESA-listed fish may only be identified and counted.

5. To minimize the lateral transfer of pathogens, a sterilized needle must be used for each individual injection when PIT-tagging ESA-listed fish.

6. The Permit Holder must not intentionally kill or cause to be killed any ESA-listed species authorized to be taken by the permit, unless the permit allows a lethal take of the ESA-listed species.

7. Due caution must be exercised during spawning ground surveys to avoid disturbing, disrupting, or harassing ESA-listed adult salmonids when they are spawning. Whenever possible, walking in the stream must be avoided, especially in areas where ESA-listed salmonids are likely to spawn.

8. Visual observation protocols must be used instead of intrusive sampling methods whenever possible. This is especially appropriate when ascertaining whether anadromous fish are merely present. Snorkeling and streamside surveys will replace electrofishing procedures whenever possible.

9. Researchers using backpack electroshocking equipment to collect ESA-listed fish must comply with NMFS' backpack electrofishing guidelines (NMFS 2000c).

10. The Permit Holder must provide plans for future undefined projects or changes in sampling locations or research protocols and obtain approval from NMFS prior to implementation.

11. Prior to each research sampling season, the Permit Holder must identify the personnel designated to act under the authority of the permit and confirm their experience through résumés or other evidence of their qualifications.

12. The Permit Holder must provide notice of intended activities at least two weeks in advance of each research sampling season to enable a NMFS official(s), or any other person(s) duly designated, to accompany researchers. The required notification shall include a detailed outline of coordination measures that will be undertaken with other researchers to ensure that no unnecessary duplication and/or adverse cumulative impacts occur as a result of the research activities.

13. The Permit Holder must report whenever the authorized level of take is exceeded, or if circumstances indicate that such an event is imminent. Notification should be made as soon as possible, but no later than two days after the authorized level of take is exceeded. The Permit Holder must then submit a detailed written report. Pending review of these

circumstances, NMFS may suspend research activities or amend the permit to allow research activities to continue.

14. The Permit Holder must report the take of any ESA-listed species not included in the permit, when it is killed, injured, or collected during the course of research activities. Notification should be made as soon as possible, but no later than two days after the unauthorized take. The Permit Holder must then submit a detailed written report. Pending review of these circumstances, NMFS may suspend research activities or amend the permit to allow research activities to continue.

15. For the duration of the permit, work in each succeeding year is contingent upon submission and approval of a report on the preceding year's activities. The report must include:

    (a) A detailed description of activities conducted under the permit including the total number of fish taken from each salmonid run, an estimate of the number of ESA-listed fish taken from each salmonid run, the manner of take, and the dates/locations of take;

    (b) Measures taken to minimize disturbances to ESA-listed fish and the effectiveness of these measures, the condition of ESA-listed fish taken and used for the research, a description of the effects of research activities on the subject species, the disposition of ESA-listed fish in the event of mortality, and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities;

    (c) Any problems that may have arisen during the research activities and a statement as to whether or not the research activities had any unforeseen effects;

    (d) A description of how all take estimates were derived;

    (e) Any preliminary analyses of the data;

    (f) Steps that have been and will be taken to coordinate the research with that of other researchers; and

    (g) If an electroshocker was used for fish collection, a copy of the logbook must be included with the report.

NMFS may also include additional conditions in a permit based on unique circumstances or the specific mitigation measures proposed by the Applicant. Additional conditions to be included in the permits, if applicable, are identified in the following descriptions of the proposed activities for each individual permit action.

The Individual Permits

The permit applications contain specific information related to each of the proposed activities, including citations of literature, that discuss some of the impacts of proposed activities and methodologies on ESA-listed anadromous salmon and steelhead. A general description of the activities associated with each proposed permit action follows.

<u>Permit Modifications/Amendments</u>

Permit 1141, Modification 3

For this permit modification, Grant County PUD requests to conduct a new study at Wanapum and Priest Rapids Dams. The new study would result in annual takes of juvenile, endangered, artificially-propagated, UCR spring chinook salmon. The purpose of the study is to (1) estimate dam and pool passage survival of ESA-listed fish at Wanapum and Priest Rapids Dams; (2) assess the travel times, approach routes, and other behavioral aspects of yearling salmonids in the forebays of Wanapum and Priest Rapids Dams; and (3) assess smolt survival at the spill gates at Wanapum Dam. Information from the study will help to increase the survival of migrating juvenile salmon and steelhead at the dams by helping managers determine future recovery strategies and mitigation alternatives. ESA-listed spring chinook salmon juveniles are proposed to be collected from the gatewells at the dams using crane-operated dipnets, tagged with balloon tags and/or radiotransmitters, released, and tracked. ESA-listed juvenile fish indirect mortalities are also requested. In addition, juvenile, endangered, artificially-propagated, UCR spring chinook salmon are proposed to be taken lethally. Modification 3 is requested to be valid for the duration of the permit (Grant County PUD 2002). The following Special Condition shall be included in Permit 1141:

> Whenever possible, ESA-listed juvenile fish indirect mortalities that occur during the conduct of research activities must be used in place of intentional lethal takes.

Permit 1322, Modification 1

For this permit modification, NWFSC requests annual takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon associated with a study that is conducted in the lower Columbia River estuary. The purpose of the study is to (1) determine the presence and abundance of fall and spring chinook salmon, coho salmon, and chum salmon in the estuary and lower Columbia River; (2) determine the relationship between juvenile salmon and the lower Columbia River estuarine habitat; and (3) obtain information about flow change, sediment input, and habitat availability for the development of a numerical model. The study will serve as the basis for estuarine restoration and preservation plans for endangered salmonid stocks. NWFSC scientists propose to capture fish using beach seines near the Astoria Bridge and propose to deploy trapnets to capture fish in Cathlamet Bay. After being captured, ESA-listed juvenile fish are proposed to be sampled for biological information and tissue samples and released. ESA-listed juvenile fish indirect mortalities are requested. In addition, ESA-listed juvenile fish are proposed to be sacrificed to obtain stomach contents, otoliths, and other tissues that will be used to assess overall health and performance (growth, condition, food habits, etc.). Modification 1 is requested to be valid for the duration of the permit (NWFSC 2002).

Permit 1335, Amendment

In its original permit application for Permit 1335, USFS requested annual takes of juvenile, endangered, naturally-produced, UCR spring chinook salmon and juvenile, endangered, naturally-produced, UCR steelhead associated with a research project to be conducted in the upper Methow River Basin. The purpose of the research is to assess the watershed conditions and the factors that limit productivity on USFS land and to determine overall watershed health under the requirements of the Northwest Forest Plan. The research will benefit the ESA-listed fish by providing information that USFS can use to improve its forest management practices. ESA-listed juvenile salmon and steelhead are proposed to be captured using backpack electrofishing, sampled for biological information, and released. ESA-listed juvenile fish indirect mortalities were also requested by USFS (USFS 2001).

Permit 1345, Amendment

In its original permit application for Permit 1345, WDFW requested annual takes of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with research to be conducted in selected rivers and tributaries throughout the state of Washington. The objective of the research is to conduct annual warmwater fish stock assessment surveys necessary for inland fish management purposes. Surveys of warmwater fish species are usually conducted in the backwater sloughs, oxbow lakes, and ponds associated with major river systems. Boat electrofishing is a critical component of WDFW's standardized sampling methodology for warmwater fish species. ESA-listed adult and juvenile salmon and steelhead are proposed to be captured using boat electrofishing, sampled for biological information, and released. ESA-listed juvenile fish indirect mortalities associated with the research were also requested by WDFW (WDFW 2001).

New Permits

Permit 1366

OCFWRU requests a five-year scientific research permit (1366) for annual takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with a research project proposed to occur at Lower Granite Dam on the lower Snake River and McNary and Bonneville Dams on the lower Columbia River. The purpose of the research is to compare biological and physiological indices of wild and hatchery juvenile fish exposed to stress from bypass, collection, and transportation activities at the dams. The research will improve the survival of the ESA-listed species at the dams by providing information that will be used to determine the effects of the manmade structures and associated management activities on the outmigrating salmonids. ESA-listed juvenile fish are proposed to be captured using lift nets or dipnets at the dams (or acquired from Smolt Monitoring Program or NMFS personnel at Bonneville Dam), sampled for biological information or tagged with radiotransmitters, and released. Up to 3 percent of the ESA-listed juvenile fish handled each year may be indirectly killed. In addition, OCFWRU requests intentional lethal takes of ESA-listed juvenile salmon and steelhead associated with the research (OCFWRU 2002).

Permit 1386

WDOE requests a five-year scientific research permit for annual takes of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon and adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with a research project proposed to occur in various streams and tributaries throughout the state of Washington. The objective of the research is to investigate the occurrence and monitor the concentrations of toxic contaminants in edible fish tissue and the freshwater environments of the state as part of the Washington State Toxics Monitoring Program. The proposed project responds in part to the state's responsibility for protecting residents from the health risks associated with the consumption of contaminated non-commercially caught fish. In addition, the proposed project responds to requirements of the federal Clean Water Act. The proposed project will help determine whether selected waters of the state meet state water quality standards for toxic contaminants in fish as well as providing information about risks to humans and wildlife from the consumption of fish. Potential benefits to ESA-listed species as a result of the project may include the development of pollution control actions such as habitat improvements and/or the reduction or removal of the sources of toxic contaminants. ESA-listed salmon and steelhead adults and juveniles are proposed to be captured annually (using nets, seines, or boat electrofishing), sampled for biological information, and released. ESA-listed juvenile salmon and steelhead indirect mortalities associated with the research are also requested by WDOE (WDOE 2002).

The Action Areas

The action area for endangered UCR spring chinook salmon includes all river reaches accessible to chinook salmon in Columbia River tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River. Also included are adjacent riparian zones, as well as mainstem river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to Chief Joseph Dam. Excluded are tribal lands and areas above specific dams (e.g., Lake Chelan hydropower project) or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for the UCR spring chinook salmon evolutionarily significant unit (ESU) comprise approximately 7,003 square miles in Washington. The following counties lie partially or wholly within these basins: Chelan, Douglas, Kittitas, and Okanogan. Critical habitat was designated for UCR spring chinook salmon in 2000 when NMFS published a final rule in the *Federal Register* (NOAA

2000). However, the critical habitat designation for UCR spring chinook salmon was vacated and remanded to NMFS for new rulemaking pursuant to a court order in May 2002. In lieu of a new rule designating critical habitat for UCR spring chinook salmon, this consultation will include an evaluation of the effects of the proposed actions on the species' habitat to determine whether those actions are likely to jeopardize the continued existence of the species.

The action area for endangered UCR steelhead includes all river reaches accessible to steelhead in Columbia River tributaries upstream of the Yakima River and downstream of Chief Joseph Dam in Washington. Also included are adjacent riparian zones, as well as mainstem river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to Chief Joseph Dam in Washington. Excluded are tribal lands and areas above specific dams (e.g., Lake Chelan hydropower project) or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for the UCR steelhead ESU comprise approximately 9,545 square miles in Washington. The following counties lie partially or wholly within these basins: Chelan, Douglas, Grant, Kittitas, Okanogan, and Yakima. Critical habitat was designated for UCR steelhead in 2000 when NMFS published a final rule in the *Federal Register* (NOAA 2000). However, the critical habitat designation for UCR steelhead was vacated and remanded to NMFS for new rulemaking pursuant to a court order in May 2002. In lieu of a new rule designating critical habitat for UCR steelhead, this consultation will include an evaluation of the effects of the proposed actions on the species' habitat to determine whether those actions are likely to jeopardize the continued existence of the species.

STATUS OF SPECIES INCLUDED IN THIS CONSULTATION

The actions considered in this consultation will affect endangered UCR spring chinook salmon and endangered UCR steelhead.

<u>UCR Spring Chinook Salmon</u>

On March 24, 1999, NMFS listed UCR spring chinook salmon as an endangered species under the ESA (NOAA 1999). In its final listing determination, NMFS concluded that the UCR spring chinook salmon ESU is in danger of extinction throughout all or a significant portion of its range. NMFS also determined that six hatchery stocks in the UCR Basin (Chiwawa, Methow, Twisp, Chewuch, and White Rivers and Nason Creek) should be considered part of the ESU, are currently essential for the recovery of the ESU, and should be listed under the ESA (NOAA 1999). WDFW operates the hatchery programs for listed UCR spring chinook salmon.

Information on the status and distribution of UCR spring chinook salmon is found in the status review prepared by NWFSC, NMFS (Myers *et al*. 1998). More recent information on the status and distribution of the chinook salmon ESU, including hatchery components of the respective populations, is provided in the status review update prepared by the West Coast Chinook Salmon Biological Review Team (NMFS 1998c) and the Evaluation of the Status of Chinook and Chum

Salmon and Steelhead Hatchery Populations for ESUs Identified in Final Listing Determinations prepared by the Conservation Biology Division of the NWFSC (NMFS 1999a).

The UCR spring-run chinook salmon ESU inhabits tributaries upstream from the Yakima River to Chief Joseph Dam. UCR spring-run chinook salmon have a stream-type life history. Three independent populations of spring-run chinook salmon are identified for the ESU including those that spawn in the Wenatchee, Entiat, and Methow River Basins (Ford *et al.* 1999). Adults return to the Wenatchee River from late March through early May, and to the Entiat and Methow Rivers from late March through June. Most adults return after spending two years in the ocean, although 20 percent to 40 percent return after three years at sea. Like Snake River spring/summer chinook salmon, UCR spring-run chinook salmon experience very little ocean harvest. Peak spawning for all three populations occurs from August to September. Smolts typically spend one year in freshwater before migrating downstream. There are slight genetic differences between this ESU and others containing stream-type fish, but more importantly, the ESU boundary was defined using ecological differences in spawning and rearing habitat (Myers *et al.* 1998). The Grand Coulee Fish Management Program (1939 through 1943) may have had a major influence on this ESU because fish from multiple populations were mixed into one relatively homogenous group and redistributed into streams throughout the upper Columbia River region.

There are no estimates of historical abundance specific to this ESU. WDFW monitors nine spring-run chinook salmon stocks geographically located within this ESU. Escapements to most tributaries are monitored by redd counts, which are expanded to total live fish based on counts at mainstem Columbia River dams. Escapements continue to be critically low in all rivers and the redd counts are still declining severely. Long-term trends in estimated abundance are mostly downward, with annual rates of change ranging from -6 percent to +1 percent over the full data set. Harvest rates have been declining recently, and are estimated to be less than ten percent (ODFW and WDFW 1995).

NMFS recently proposed interim recovery abundance levels and cautionary levels (i.e., interim levels subject to change). Ford *et al.* (1999) characterize cautionary levels as abundance levels that the population fell below only about ten percent of the time during a historical period when it was considered to be relatively healthy. Escapements for UCR spring-run chinook salmon have been substantially below the cautionary levels in recent years, especially during 1995, indicating increasing risk to and uncertainty about the population's future status.

NMFS' primary concerns center on very low abundance and distribution and strongly negative trends and stock productivity for this ESU. The average recent adult escapement to the tributaries in the ESU has been less than 5,000 hatchery and wild chinook salmon combined; all individual populations consist of less than 100 fish (NMFS 1998c). At these population sizes, the negative effects of demographic and genetic stochastic processes are likely. Furthermore, both long- and short-term trends in abundance are declining. The abundance of the spring chinook salmon returning to the Methow River Basin has been so low that all fish returning in 1996 and 1998 were intercepted at Wells Dam and were incorporated into artificial propagation programs at Methow Fish Hatchery. In addition, the captive broodstock programs underway on the Twisp and White Rivers and Nason Creek indicate the severity of the population declines.

Historical artificial propagation efforts have had a significant impact on spring-run chinook salmon populations in this ESU. Extensive introductions of spring-run chinook salmon from outside the ESU and within-ESU egg transfers that occurred in the past have left their mark on the genetic legacy of the fish remaining in the ESU. Artificial propagation recently has focused on supplementing naturally spawning populations in this ESU (Bugert 1996), although it should be emphasized that these naturally spawning populations were founded by the same homogenized stock produced during implementation of the Grand Coulee Fish Management Program (1939-1943). Furthermore, the potential exists for hatchery-derived non-native stocks to adversely affect naturally spawning populations. In addition, Howell *et al.* (1985), Chapman *et al.* (1991), Mullan *et al.* (1992), and Chapman *et al.* (1995) have suggested that the prevalence of bacterial kidney disease in upper Columbia and Snake River hatcheries is directly responsible for the low survival of hatchery stocks.

<u>UCR Steelhead</u>
On August 18, 1997, NMFS listed UCR steelhead as an endangered species under the ESA (NOAA 1997). NMFS concluded that the UCR steelhead ESU is in danger of extinction throughout all or a significant portion of its range. NMFS also determined that one hatchery stock in the upper Columbia River Basin, the Wells Hatchery stock, should be considered part of the ESU, is currently essential for the recovery of the ESU, and should be listed under the ESA (NOAA 1997). WDFW operates the Wells Hatchery steelhead program.

Information on the status and distribution of UCR steelhead is found in the status review prepared by the NWFSC, NMFS (Busby *et al*. 1996). More recent information on the status and distribution of the steelhead ESU, including hatchery components of the respective populations, is provided in the status review update prepared by the West Coast Steelhead Biological Review Team (NMFS 1997) and the Evaluation of the Status of Chinook and Chum Salmon and Steelhead Hatchery Populations for ESUs Identified in Final Listing Determinations prepared by the Conservation Biology Division of the NWFSC, NMFS (NMFS 1999a).

Steelhead can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner *et al.* 1992). The stream-maturing type, or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, whereas others only have one run type. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females (Nickelson *et al.* 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996). Multiple spawnings for steelhead range from three percent to 20 percent of runs in Oregon coastal streams. Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973).

UCR steelhead inhabit the Columbia River reach and its tributaries upstream of the Yakima River. This region includes several rivers that drain the east slopes of the Cascade Mountains and several that originate in Canada (only U.S. populations are included in the ESU). Dry habitat conditions in this area are less conducive to steelhead survival than in many other parts of the Columbia River Basin (Mullan *et al.* 1992a). Although the life history of this ESU is similar to that of other inland steelhead, smolt ages are some of the oldest on the West Coast (up to seven years old), probably due to the ubiquitous cold water temperatures (Mullan *et al.* 1992b). Adults spawn later than in most downstream populations, remaining in freshwater up to a year before spawning. Most current natural production occurs in the Wenatchee and Methow River systems, with a smaller run returning to the Entiat River (WDF *et al.* 1993). Very limited spawning also occurs in the Okanagan River Basin. Most of the fish spawning in natural production areas are of hatchery origin.

Despite numerous efforts to halt and reverse declining trends in west coast steelhead, it is clear that the status of many native, naturally-producing populations has continued to deteriorate. Estimates of historical (pre-1960s) abundance specific to the UCR steelhead ESU are available from fish counts at dams. Counts at Rock Island Dam from 1933 to 1959 averaged 2,600 to 3,700, suggesting a pre-fishery run size in excess of 5,000 adults for tributaries above Rock Island Dam (Chapman *et al.* 1994). Runs may have already been depressed by lower Columbia River fisheries at this time. Steelhead in the upper Columbia River ESU continue to exhibit low abundances, both in absolute numbers and in relation to numbers of hatchery fish throughout the region. Data from this ESU include separate total and natural run sizes, allowing the separation of hatchery and natural fish abundance estimates for at least some areas in some years.

A review of recent data indicates that natural steelhead abundance has declined or remained low in the major river basins in this ESU (Wenatchee, Methow, Okanogan) since the early 1990s. The return of UCR natural-origin steelhead to Priest Rapids Dam declined from a 5-year average of 2,700 beginning in 1986 to a 5-year average of 900 beginning in 1994 (FPC 2000). The escapement goal for natural-origin fish is 4,500. Recent five-year (1989-1993) average natural escapements are available for two stock units: Wenatchee River-- 800 steelhead, and Methow and Okanogan Rivers-- 450 steelhead. Recent average total escapements for these stocks were 2,500 and 2,400 respectively. Average total run size at Priest Rapids Dam for the same period was approximately 9,600 adult steelhead. Trends in total (natural and hatchery) adult escapement are available for the Wenatchee River (2.6 percent annual increase, 1962-1993) and the Methow and Okanogan Rivers combined (12 percent annual decline, 1982-1993). These two stocks represent most of the escapement to natural spawning habitat within the range of the ESU.

Estimates of natural production in this steelhead ESU are well below replacement (approximately 0.3:1 adult replacement ratios in the Wenatchee and Entiat Rivers). These data indicate that natural steelhead populations in the upper Columbia River Basin are not self-sustaining at the present time. The Biological Review Team discussed anecdotal evidence that resident rainbow trout, which are in numerous streams throughout the region, contribute to anadromous run abundance. This phenomenon would reduce estimates of the natural steelhead replacement ratio.

The entire ESU has been subjected to heavy hatchery influence; stocks became thoroughly mixed as a result of the Grand Coulee Fish Management Program, which began in the 1940s (Fish and Hanavan 1948, Mullan *et al.* 1992a). Recently, as part of the development of the Mid-Columbia Habitat Conservation Plan, it was determined that steelhead habitat within the range of the ESU was overseeded, primarily due to the presence of Wells Hatchery fish in excess of those collected for broodstock. This would partially explain recent observations of low natural cohort replacement rates (0.3 for populations in the Wenatchee River and no greater than 0.25 for populations in the Entiat River; Bugert 1997). The problem of determining appropriate levels of hatchery output to prevent negative effects on natural production is a subject of analysis and review in the Mid-Columbia Quantitative Analytical Report (Cooney 2000). In the meantime, given these uncertainties, efforts are under way to diversify broodstocks used for supplementation and to minimize the differences between hatchery and natural-origin fish (as well as other concerns associated with supplementation). The best use for the Wells Hatchery program in the recovery process is yet to be defined and should be integrated with harvest activities and recovery measures to optimize the prospects for recovery of the species.

The proportion of hatchery fish is high in these rivers (65-80 percent). In addition, substantial genetic mixing of populations within this ESU has occurred, both historically (as a result of the Grand Coulee Fish Management Program) and more recently as a result of the Wells Hatchery program. Extensive mixing of hatchery stocks throughout this ESU, along with the reduced opportunity for maintenance of locally adapted genetic lineages among different drainages, represents a considerable threat to steelhead in this region.

ENVIRONMENTAL BASELINE

Environmental baselines for biological opinions are defined by regulation at 50 CFR402.02. The environmental baseline for this biological opinion includes the effects of several forms of activities, summarized below, that affect the survival and recovery of UCR spring chinook salmon and UCR steelhead. The biological requirements of both UCR spring chinook salmon and UCR steelhead are currently not being met under their respective environmental baselines. Their status is such that there must be a significant improvement in the environmental conditions of the species' respective habitats (over those currently available under the environmental baselines). Any further degradation of the environmental conditions would have a significant impact due to the amount of risk the species presently face under the environmental baselines.

The best scientific information presently available suggests that a multitude of factors, past and present, have contributed to the decline of west coast salmonids. NMFS reviewed much of that information in its recent biological opinion on "Reinitiation of Consultation on Operation of the Federal Columbia River Power System (FCRPS), Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin" (NMFS 2000d), and that review is summarized here. NMFS recognizes that natural environmental fluctuations have likely played a role in the species' recent declines. However, NMFS believes that other human-induced impacts (e.g., harvest in certain fisheries, artificial propagation, water diversions, and widespread habitat modification) have played an equally significant role in the decline of these species. While at-risk salmonid stocks may benefit from a reversal in the current climate/ocean regime, resource managers need to focus on reducing impacts from harvest and artificial propagation and improving freshwater and estuarine habitats.

The Species' Biological Requirements in the Action Areas

UCR spring chinook salmon and UCR steelhead reside in, or migrate through, the action areas considered in this consultation. The biological requirements during the species' life history stages can be obtained by identifying the essential features of their critical habitat. Essential features include adequate: (1) substrate (especially spawning gravel), (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) migration conditions. As discussed below there are numerous factors affecting these requirements in the action area.

Factors Affecting the Species in the Action Areas

Hydropower System Effects on the Baseline

Anadromous salmonids in the Columbia River Basin have been dramatically affected by the development and operation of the FCRPS on the lower Snake and Columbia Rivers. Storage dams have eliminated spawning and rearing habitat and have altered the natural hydrograph of the Snake and Columbia Rivers, decreasing spring and summer flows and increasing fall and winter flows. Power operations cause flow levels and river elevations to fluctuate, affecting fish movement through reservoirs and riparian ecology, and stranding fish in shallow areas. The dams in the migration corridor alter smolt and adult migrations. Smolts experience a high level of mortality passing the dams. The dams also have converted the once-swift river into a series of slow-moving reservoirs, slowing the smolts' journey to the ocean and creating habitat for predators. Water velocities throughout the migration corridor now depend far more on volume runoff than before the development of the mainstem reservoirs.

There have been numerous changes in the operation and configuration of the FCRPS as a result of ESA consultations between NMFS and BPA, the Corps, USFWS, and the Bureau of Reclamation. The changes have improved survival for the ESA-listed fish migrating through the Snake and Columbia Rivers. Increased spill at the dams allows smolts to avoid both turbine intakes and bypass systems. Increased flow in the mainstem Snake and Columbia Rivers provides better inriver conditions for smolts. The transportation of smolts from the Snake River has also been improved by the addition of new barges and modification of existing barges. In addition to spill, flow, and transportation improvements, the Corps implemented numerous other improvements to project operations and maintenance at all FCRPS dams on the Snake and Columbia Rivers.

It is possible to quantify the survival benefits accruing from many of these strategies for each of the ESA-listed anadromous fish ESUs. For Snake River spring/summer chinook salmon smolts migrating inriver, the estimated survival through the hydrosystem is now between 40 percent and 60 percent, compared with an estimated survival rate during the 1970s of 5 percent to 40 percent. Snake River steelhead have probably received a similar benefit because their life history and run timing are similar to those of spring/summer chinook salmon (NMFS 2000b). It is more difficult to obtain direct data and compare survival improvements for fish transported from the Snake River, but there are likely to be improvements for transported fish as well. It is reasonable to expect that the improvements in operation and configuration of the FCRPS will benefit all ESA-listed Columbia River Basin salmonids and that the benefits will be greater the farther upriver the ESU. However, further improvements are necessary because the Federal hydrosystem continues to cause a significant level of mortality for some ESUs.

Several non-Federal projects licensed by the Federal Energy Regulating Commission (FERC) also affect UCR spring chinook salmon and UCR steelhead on the mainstem Columbia River. Operations of the Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids Dams are currently governed by existing FERC license requirements and settlement agreements. Each of these license requirements and settlement agreements specify actions intended to reduce the effects of project operations on anadromous salmonids. A spring flow objective for the Mid-Columbia River was established in the 1998 FCRPS Supplemental Biological Opinion (NMFS 1998b). The flow objective established for steelhead migrating through the Columbia River above McNary Dam is 135 kcfs as measured at Priest Rapids Dam.

It is unclear at this time how the cumulative impacts of FERC-licensed and FCRPS hydropower project operations affect long-term fish health and survival. Given that this gap in our understanding constitutes a critical uncertainty, NMFS believes that additional actions should occur at each of the FERC-licensed and FCRPS hydropower projects in order to maximize the survival of all life stages of UCR spring chinook salmon and UCR steelhead in the action areas.

Habitat Effects on the Baseline

The quality and quantity of freshwater habitat in much of the Columbia River Basin have declined dramatically in the last 150 years. Forestry, agriculture, road construction, hydrosystem development, mining, and urbanization have radically changed the historical habitat conditions of the basin. With the exception of fall chinook, which generally spawn and rear in the mainstem rivers, salmon and steelhead spawning and rearing habitat is found in the tributaries to the Snake and Columbia Rivers. Anadromous fish typically spend from a few months to three years rearing in freshwater tributaries. Depending on the species, they spend from a few days to one or two years in the Columbia River estuary before migrating out to the ocean and another one to four years in the ocean before returning as adults to spawn in their natal streams.

Water quality in streams throughout the Columbia River Basin has been degraded by human activities such as dams and diversion structures, water withdrawals, farming and animal grazing, road construction, timber harvest activities, mining activities, and urbanization. Over 2,500 streams and river segments and lakes do not meet Federally-approved, state and Tribal water quality standards and are now listed as water-quality-limited under Section 303(d) of the Clean Water Act. Tributary water quality problems contribute to poor water quality where sediment and contaminants from the tributaries settle in mainstem reaches and the estuary.

Most of the water bodies in Oregon, Washington, and Idaho that are on the 303(d) list do not meet water quality standards for temperature. Temperature alterations affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that result in high stream temperatures are the removal of trees or shrubs that directly shade streams, excessive water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals have contributed to lower base-stream flows, which in turn contribute to temperature increases. Channel widening and land uses that create shallower streams also cause temperature increases.

Pollutants also degrade water quality. Salmon require clean gravel for successful spawning, egg incubation, and the emergence of fry. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon and steelhead.

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Millions of acres of land in the basin are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban, and other uses can increase temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers.

On a larger landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density, which can affect the timing and duration of runoff. Many riparian areas, flood plains, and wetlands that once stored water during periods of high runoff have been developed. Urbanization paves over or compacts soil and increases the amount and pattern of runoff reaching rivers and streams.

Blockages that stop the downstream and upstream movement of fish exist at many agricultural, hydrosystem, municipal/industrial, and flood control dams and barriers. Highway culverts that are not designed for fish passage also block upstream migration. Migrating fish are diverted into unscreened or inadequately screened water conveyances or turbines, resulting in unnecessary mortality. While many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout the basin.

Land ownership has played a part in habitat and land-use changes. Federal lands, which compose 50 percent of the basin, are generally forested and influence upstream portions of the watersheds. While there is substantial habitat degradation across all ownerships, in general, habitat in many headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt *et al*. 1993, Frissell 1993, Henjum *et al*. 1994, Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992, Spence *et al*. 1996, ISG 1996). Today, agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

Mainstem habitats of the Columbia and Snake Rivers have been affected by impoundments that have inundated large amounts of spawning and rearing habitat. Historically, fall chinook salmon spawned in the mainstem near The Dalles, Oregon, upstream to the Pend Oreille River in Washington and the Kootenai River in Idaho and in the Snake River downstream of Shoshone Falls. Current mainstem production areas for fall chinook salmon are mostly confined to the Hanford Reach of the mid-Columbia River and to the Hells Canyon Reach of the Snake River, with minor spawning populations elsewhere in the mid-Columbia River, below the lower Snake River dams, and below Bonneville Dam. Mainstem habitat in the Columbia and Snake Rivers has been reduced, for the most part, to a single channel, floodplains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced. Most of the remaining habitats are affected by flow fluctuations associated with reservoir management.

The Columbia River estuary has also been changed by human activities. Navigation channels have been dredged, deepened and maintained, jetties and pile-dike fields have been constructed to stabilize and concentrate flow in navigation channels, marsh and riparian habitats have been filled and diked, and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia River to two miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet. More than 50 percent of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreational, agricultural, or urban uses. More than 3,000 acres of intertidal marsh and spruce swamps have been converted to other uses since 1948 (LCREP 1999). Many wetlands along the shore in the upper reaches of the estuary have been converted to industrial and agricultural lands after levees and dikes were constructed. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced, and the amount of water discharged during winter has increased.

The Basinwide Recovery Strategy (Federal Caucus 2000) outlines a broad range of current programs designed to improve habitat conditions for anadromous fish. Because most of the basin's anadromous fish spawning habitat is in Federal ownership, Federal land management programs are of primary importance. Examples of Federal actions likely to affect salmonids in the ESA-listed ESUs include authorized land management activities of the USFS and Bureau of

Land Management (BLM). Federal actions, including the Corps' section 404 permitting activities under the Clean Water Act, the Corps' permitting activities under the River and Harbors Act, National Pollution Discharge Elimination System permits issued by EPA, highway projects authorized by the Federal Highway Administration, Federal Energy Regulatory Commission licenses for non-Federal development and operation of hydropower, and Federal hatcheries may result in impacts to ESA-listed anadromous fish.

Several recovery efforts are underway that may slow or reverse the decline of salmon and steelhead populations. Notable efforts within the range of the Snake River salmonid ESUs are the Northwest Forest Plan (NFP), PACFISH, Washington Wild Stock Restoration Initiative, and Washington Wild Salmonid Policy. PACFISH is an ecosystem-based aquatic habitat and riparian-area management strategy that covers the majority of the basin accessible to anadromous fish and includes specific prescriptions designed to halt habitat degradation. PACFISH provides objectives, standards, and guidelines that are applied to all Federal land management activities such as timber harvest, road construction, mining, grazing, and recreation. USFS and BLM implemented PACFISH beginning in 1995. Several other efforts are also being carried forward by NMFS, USFS, and BLM. These components include (but are not limited to) implementation monitoring and accountability, a system of watersheds that are prioritized for protection and restoration, improved and monitored grazing systems, road system evaluation and planning requirements, mapping and analysis of unroaded areas, multi-year restoration strategies, and batching and analyzing projects at the watershed scale.

The most significant element of the NFP for anadromous fish is its Aquatic Conservation Strategy (ACS), a regional-scale aquatic ecosystem conservation strategy that includes: (1) Special land allocations (such as key watersheds, riparian reserves, and late-successional reserves) to provide aquatic habitat refugia; (2) special requirements for project planning and design in the form of standards and guidelines; and (3) new watershed analysis, watershed restoration, and monitoring processes. These components collectively ensure that Federal land management actions achieve ACS objectives that strive to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources and to restore currently degraded habitats.

The Basinwide Recovery Strategy also outlines a large number of non-Federal habitat programs. Because non-Federal habitat is managed predominantly for private rather than public purposes, expectations for non-Federal habitat are harder to assess. Degradation of habitat for ESA-listed fish from activities on non-Federal lands is likely to continue to some degree, although at a reduced rate due to state, tribal, and local recovery plans. Because a substantial portion of land in the ESA-listed salmonid ESUs is in state or private ownership, conservation measures on these lands will be key to protecting and recovering ESA-listed salmon and steelhead populations. NMFS recognizes that strong conservation benefits will accrue from specific components of many non-Federal conservation efforts, however, some of those conservation efforts are very recent and few address salmon conservation at a scale that is adequate to protect and conserve entire ESUs. NMFS will continue to encourage non-Federal landowners to assess the impacts of their actions on ESA-listed salmonids. In particular, NMFS will encourage state and local governments to use their existing authorities and programs, and will encourage the formation of watershed partnerships to promote conservation in accordance with ecosystem principles.

Hatchery Effects on the Baseline

For more than 100 years, hatcheries in the Pacific Northwest have been used to replace natural production lost as a result of the construction of hydropower dams and other development, not to protect and rebuild naturally-produced salmonid populations. As a result, most salmonid populations in the region are primarily hatchery fish. In 1987, for example, 95 percent of the coho salmon, 70 percent of the spring chinook salmon, 80 percent of the summer chinook salmon, 50 percent of the fall chinook salmon, and 70 percent of the steelhead returning to the Columbia River Basin originated in hatcheries (CBFWA 1990). While hatcheries certainly have contributed greatly to the overall numbers of salmonids, only recently has the effect of hatcheries on native wild populations been demonstrated. In many cases, these effects have been substantial. For example, the production of hatchery fish, among other factors, has contributed to the 90 percent reduction in wild coho salmon runs in the lower Columbia River over the past 30 years (Flagg et al. 1995). Hatcheries have traditionally focused on providing fish for harvest, with less attention given to identifying and resolving factors causing declines of native runs.

NMFS has identified four primary categories of risk that hatcheries can pose on wild-run salmon and steelhead: (1) ecological effects, (2) genetic effects, (3) overharvest effects, and (4) masking effects (NMFS 2000a). Ecologically, hatchery fish can increase predation on, displace, and/or compete with wild fish. These effects are likely to occur when fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods during which they may prey on or compete with wild fish. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release diseases into streams via water effluents. Genetically, hatchery fish can affect the genetic variability of native fish via interbreeding, either intentionally or accidentally. Interbreeding can also result from the introduction of native stocks from other areas. Theoretically, interbred fish are less adapted to and productive within the unique local habitats where the original native stock evolved.

Hatcheries have traditionally focused on providing fish for harvest, with less attention given to identifying and resolving factors causing declines of native runs. However, when wild fish mix with hatchery stock, fishing pressure can lead to overharvest of smaller or weaker wild stocks. Further, when migrating adult hatchery and wild fish mix on the spawning grounds, the health of the wild runs and the condition of the habitat's ability to support runs can be overestimated, because the hatchery fish mask surveyors' ability to discern actual wild run conditions.

The role of hatcheries in the future of Pacific Northwest salmon and steelhead is presently unclear; it will depend on the values people place on fish production and biological diversity. Clearly, conservation of biological diversity is gaining support, and the future role of hatcheries may shift toward judicial use of hatcheries to meet these goals rather than opposing them. One of the prime recommendations in the National Research Council's (NRC's) study of salmon in the Pacific Northwest is that hatchery use "should occur within the context of fully implemented adaptive-management programs that focus on watershed management, not just on the fish themselves" (NRC 1996). A recent review of this approach for the Columbia River Basin can be found in ISAB (1998).

Harvest Effects on the Baseline

Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. The development of non-Indian fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fisheries used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and trolling (using hook and line) fisheries developed. Recreational (sport fishing) began in the late 1800s, occurring primarily in tributary locations (ODFW and WDFW 1998).

Initially, the non-Indian fisheries targeted spring and summer chinook salmon, and these runs dominated the commercial harvest during the 1800s. Eventually the combined ocean and freshwater harvest rates for Columbia River spring and summer chinook salmon exceeded 80 percent and sometimes 90 percent of the run, contributing to the species' decline (Ricker 1959). From 1938 to 1955, the average harvest rate dropped to about 60 percent of the total spring chinook salmon run and appeared to have a minimal effect on subsequent returns (NMFS 1991). Until the spring of 2000, when a relatively large run of hatchery spring chinook salmon returned and provided a small commercial Tribal fishery, the last commercial season for spring chinook salmon had occurred in 1977. The summer chinook salmon run could not sustain the average harvest rate of 88 percent that was applied between 1938 to 1944 and produced lower returns between 1942 and 1949 (NMFS 1991). From 1945 through 1949, the Columbia River harvest rate on summer chinook salmon was reduced to about 47 percent, and subsequently, the run size increased. The construction of Grand Coulee Dam in 1941, with the resulting inundation of summer chinook salmon spawning areas, was a primary factor influencing this species' declining abundance. In the 1950s and 1960s, harvest rates further declined to about 20 percent (Raymond 1988). This species has not been the target of any commercial harvest since 1963.

Following the sharp declines in spring and summer chinook salmon in the late 1800s, fall chinook salmon became a more important component of the catch. Fall chinook salmon have provided the greatest contribution to Columbia River salmon catches in most years since 1890. Through the first part of this century, the commercial catch was usually canned for marketing. The peak year of commercial sales was 1911, when 49.5 million pounds of fall chinook salmon were landed. Columbia River chinook salmon catches were generally stable from the beginning of commercial exploitation until the late 1940s, when landings declined by about two-thirds to a level that remained stable from the 1950s through the mid-1980s (ODFW and WDFW 1998). Since 1938, total salmonid landings have ranged from a high of about 2,112,500 fish in 1941 to a low of about 68,000 fish in 1995 (ODFW and WDFW 1998).

Whereas freshwater fisheries in the basin were declining during the first half of this century, ocean fisheries were growing, particularly after World War II. This trend occurred up and down the West Coast as fisheries with new gear types leapfrogged over the others to gain first access to the migrating salmon runs. Large, mixed-stock fisheries in the ocean gradually supplanted the freshwater fisheries, which were increasingly restricted or eliminated to protect spawning escapements. By 1949, the only freshwater commercial gear types remaining were gill nets, dip nets, and hoop nets (ODFW and WDFW 1998). Ocean trolling peaked in the 1950s; recreational fishing peaked in the 1970s. The ocean harvest has declined since the early 1980s as a result of declining fish populations and increased harvest restrictions (ODFW and WDFW 1998).

The construction of The Dalles Dam in 1957 had a major effect on Tribal fisheries. The Dalles Reservoir flooded Celilo Falls and inundated the site of a major Indian fishery that had existed for millennia. Commercial Indian landings at Celilo Falls from 1938 through 1956 ranged from 0.8 to 3.5 million pounds annually, based primarily on dip netting (ODFW and WDFW 1998). With the elimination of Celilo Falls, salmon harvest in the area declined dramatically. In 1957, in a joint action, the states of Oregon and Washington closed the Tribal fishery above Bonneville Dam to commercial harvesters. Treaty Indian fisheries that continued during 1957 through 1968 were conducted under Tribal ordinances. In 1968, with the Supreme Court opinion on the appeal of the *Puyallup v. Washington* case, the states reopened the area to commercial fishing by treaty Indians (ODFW and WDFW 1998). For the next 6 years, until 1974, only a limited Tribal harvest occurred above Bonneville Dam. By then, the Tribal fishery had developed an alternative method of setting gill nets that was suitable for catching salmon in the reservoirs (ODFW and WDFW 1998).

The capacity of salmonids to produce more adults than are needed for spawning offers the potential for sustainable harvest of naturally-produced fish. This potential can be realized only if two basic management requirements are met: (1) enough adults return to spawn and perpetuate the run, and (2) the productive capacity of the habitat is maintained. Catches may fluctuate in response to such variables as ocean productivity cycles, periods of drought, and natural disturbance events. However, as long as the two management requirements are met, fishing can be sustained indefinitely. Unfortunately, both prerequisites for sustainable harvest have been violated routinely in the past. The lack of coordinated management across jurisdictions, combined with competitive economic pressures to increase catches or to sustain them in periods of lower production, resulted in harvests that were too high and escapements that were too low. At the same time, habitat has been increasingly degraded, reducing the capacity of the salmon stocks to produce numbers in excess of their spawning escapement requirements.

For years, the response to declining catches was hatchery construction to produce more fish. Because hatcheries require fewer adults to sustain their production, harvest rates in the fisheries were allowed to remain high, or even increase, further exacerbating the effects of overfishing on the naturally-produced (non-hatchery) runs. More recently, harvest managers have instituted reforms including weak stock, abundance-based, harvest rate, and escapement-goal management.

Effects of Natural Conditions on the Baseline

Changes in the abundance of salmonid populations are substantially affected by changes in the freshwater and marine environments. Recent evidence suggests that marine survival of salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Hare *et al*. 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation. For example, large-scale climatic regimes, such as El Niño, appear to affect changes in ocean productivity. During the first part of the 1990s much of the Pacific Coast was subject to a series of very dry years. In more recent years, severe flooding has adversely affected some stocks. Thus the survival and recovery of these species will depend on their ability to persist through periods of low natural survival rates.

A key factor affecting many West Coast stocks has been the general pattern of a 30-year decline in ocean productivity. The mechanism whereby stocks are affected is not well understood. The pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven largely by events occurring between ocean entry and recruitment to a subadult life stage. One indicator of early ocean survival can be computed as a ratio of coded-wire tag (CWT) recoveries of subadults relative to the number of CWTs released from that brood year. Time-series of survival rate information for upper Willamette River spring chinook salmon, Lewis River fall chinook salmon, and Skagit fall chinook salmon show highly variable or declining trends in early ocean survival, with very low survival rates in recent years (NMFS 1999b).

Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to significant natural mortality, although the levels of predation are largely unknown. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the rebound of seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, has resulted in substantial mortality for salmonids. In recent years, for example, sea lions have learned to target upper Willamette River spring chinook salmon in the fish ladder at Willamette Falls.

Studies begun in 1997 by the Oregon Cooperative Fish and Wildlife Research Unit, USGS, and CRITFC have shown that fish-eating birds that nest on islands in the Columbia River estuary (Caspian terns, double-crested cormorants, and glaucous-winged gulls) are significant avian predators of juvenile salmonids. Researchers estimated that the tern population on Rice Island (16,000 birds in 1997) consumed 6 to 25 million outmigrating smolts during 1997 (Roby *et al*.1998) and 7 to 15 million outmigrating smolts during 1998 (Collis *et al*. 1999). The observed levels of predation prompted the regional fish and wildlife managers to investigate the feasibility of management actions to reduce the impacts. Early management actions appear to have reduced predation rates; researchers estimate that terns consumed 7.3 million smolts during 1999 (Columbia Bird Research 2000).

Finally, it should be noted that the unusual drought conditions in 2001 warrant additional consideration. The available water in the Columbia River Basin was 50-60 percent of normal and resulted in some of the lowest flow conditions on record. These conditions had the greatest effect on upriver stocks such as the ones being discussed in this opinion. The juveniles that passed down river during the 2001 spring and summer out-migration were likely affected and adult returns in 2003 and 2004 may also be affected, depending on the stock and species. At this time, it is impossible to ascertain what those effects will be, but NMFS is carefully monitoring the situation and will take the drought condition into account in any management decision, including amending take authorizations and other permit conditions.

Effects of Scientific Research, Monitoring, and Enhancement Activities on the Baseline

UCR spring chinook salmon and UCR steelhead, like other ESA-listed fish, are the subject of scientific research, monitoring, and enhancement activities. Most biological opinions that NMFS issues recommend specific monitoring, evaluation, and research projects to gather information to aid in the survival of ESA-listed fish. In addition, NMFS has issued numerous research permits authorizing takes of ESA-listed fish over the last few years. Each authorization for take by itself would not lead to decline of the species. However, the sum of the authorized takes indicate a high level of research effort in the action area, and as anadromous fish stocks have continued to decline, the proportion of fish handled for research/monitoring purposes relative to the total number of fish has increased. The effect of these activities is difficult to assess, nevertheless, the potential benefits to ESA-listed salmon and steelhead from the scientific information is likely to be greater than the potential risk to the species due to those efforts. Potential benefits include enhancing the scientific knowledge base for the species and answering questions or contributing information toward resolving difficult resource issues. The information gained during research and monitoring activities will assist resource managers in making more informed decisions regarding recovery measures. Moreover, scientific research, monitoring, and enhancement efforts are not considered to be a factor contributing to the decline of UCR spring chinook salmon and UCR steelhead populations.

To reduce adverse effects from research and enhancement activities on the species, NMFS imposes conditions in its permits so that Permit Holders conduct their activities in such a way as to minimize adverse effects on the ESA-listed species, including keeping mortalities as low as possible. Also, researchers are encouraged to use non-listed fish species and/or ESA-listed hatchery fish, instead of ESA-listed, naturally-produced fish, for scientific research purposes when possible. In addition, researchers are required to share sample fish, as well as the results of the scientific research, with other researchers and comanagers in the region as a way to avoid duplicative research efforts and to acquire as much information as possible from the ESA-listed fish sampled. NMFS also works with other agencies to coordinate research underway to prevent duplication of effort.

In general, for projects that require a section 10(a)(1)(A) permit, applicants will provide NMFS with high take estimates to compensate for potential inseason changes to research protocols, accidental catastrophic events, and the annual variability in ESA-listed fish numbers. Also, most research projects depend on annual funding and the availability of other resources. So, a specific research project for which take of ESA-listed species is authorized by a permit may be suspended in a year when funding or resources are not available. Therefore, the actual take in a given year for most research projects and enhancement efforts, as provided to NMFS in post-season annual reports, is usually less than the authorized level of take in the permits and the related NMFS consultation on the issuance of those permits. Therefore, because actual take levels tend to be lower than authorized takes, the severity of effects to the ESA-listed species to result from the conduct of scientific research and enhancement activities are usually less than the effects analyzed in a typical consultation.

A substantial amount of the annual take of ESA-listed salmon and steelhead is related to assessing the impact of the hydropower dams on the mainstem Snake and Columbia Rivers. Scientific research, monitoring, and enhancement activities are required by the Reasonable and Prudent Alternative of the "Reinitiation of Consultation on Operation of the FCRPS, Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin" (NMFS 2000d). The Corps' Juvenile Fish Transportation Program results in a substantial amount of annual take of ESA-listed UCR salmon and steelhead for enhancement purposes (to get the outmigrating juvenile fish past the concrete dams). For a description of the annual takes of ESA-listed UCR salmon and steelhead associated with the hydropower dams on the mainstem Snake and Columbia Rivers, refer to the December 21, 2000 FCRPS biological opinion (NMFS 2000d) and the biological opinion on the "Issuance of an Amendment of ESA Section 10(a)(1)(A) Permit 1237 for Takes of Six Endangered or Threatened Species for the Purpose of Enhancement" issued on April 26, 2001 (NMFS 2001a).

ANALYSIS OF THE EFFECTS OF THE PROPOSED ACTIONS

Description of Effects on Habitat

In general, the types of activities that could result in impacts to the ESA-listed species' habitat include streamside surveys, instream surveys, and the use of nets, seines, smolt traps, and electrofishing to obtain fish for research purposes. There will be a minimal amount of disturbance to vegetation, and no harm to spawning or rearing habitat, or to water quantity and water quality. Many of these activities will be of short duration, during limited field opportunities linked to migration patterns of the targeted populations. Thus, there will be minimal effects on the species' respective habitats from the actions discussed in this consultation. Additionally, the effects are not likely to be substantial enough to contribute to a decline in the values of the habitat.

Description of General Effects on UCR Spring Chinook Salmon and UCR Steelhead

The purpose of this section is to identify the general effects on endangered UCR spring chinook salmon and endangered UCR steelhead due to NMFS' issuance of scientific research permits. For some of the research activities, the takes of ESA-listed salmonids occur on the mainstem rivers and/or at the hydropower dams on the mainstem rivers. Researchers are not able to distinguish between the different populations when working outside of the tributary watersheds from which the fish originate. As such, for research that occurs on the mainstem rivers, the analyses are not sensitive enough to evaluate the effects of proposed research activities on the ESA-listed species at the population level because of insufficient information. To the extent currently possible, this analysis will include analyses of effects at the population level. Where information on ESA-listed chinook salmon and steelhead at the population level does not exist, this analysis assumes that the status of each affected population is the same as the respective ESU as a whole.

ESA-listed juvenile salmon and steelhead abundance can vary considerably from year-to-year based on levels of adult escapement, natural fluctuations in environmental conditions, or anthropogenic effects. In addition, the number of ESA-listed juvenile fish impacted by the scientific research that occurs on the mainstem Snake and Columbia Rivers is directly related to the proportion of fish transported by barge and truck around the hydropower dams each year as part of the Corps' Juvenile Fish Transportation Program. In an effort to estimate juvenile salmon and steelhead abundance, NWFSC, NMFS has developed an algorithm that is used each year to calculate juvenile salmon and steelhead outmigration levels at the hydropower dams on the mainstem Snake and Columbia Rivers. These estimates have become a standardized tool that is used by virtually all the Permit Holders in the region to estimate annual ESA-listed juvenile fish takes associated with their respective activities. Schiewe (2002) provides the ESA-listed juvenile salmon and steelhead outmigration estimates for 2002. **For the analyses in this consultation, the estimates under the transportation with spill scenario from Schiewe (2002) will be used since that was the applicable scenario for the 2002 outmigration season.**

The various proposed activities would cause many types of take, and while there is some blurring of the lines between what constitutes an activity (e.g., electrofishing) and what constitutes a take category (e.g., harm), it is important to keep the two concepts separate. The reason for is this is that the effects being measured here are those which the activity itself has on the ESA-listed species. They may be expressed in terms of the take categories (e.g., how many UCR spring chinook salmon are harmed, or harassed, or even killed), but the actual mechanisms of the effects themselves (i.e., the activities) are the causes of whatever take arises and, as such, they bear examination.

The following subsections describe the types of activities being proposed. Because they would all be carried out by trained professionals using established protocols and have widely recognized specific impacts, each activity is described in terms broad enough to apply to every proposed permit action. This is especially true in light of the fact that the researchers would not receive a permit unless their activities (e.g., electrofishing) incorporate NMFS' uniform, pre-established set of mitigation measures. These measures are described in the *Description of the Proposed Actions* section above. They are incorporated (where relevant) into every permit as part of the terms and conditions to which a researcher must adhere.

Observation/Harassment

Harassment is a primary form of take associated with the proposed activities, and includes stress and other sub-lethal effects from observation and capture/handling. The ESA does not define harassment nor has NMFS defined this term through regulation pursuant to the ESA. However, USFWS defines "harassment as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering" [50 CFR 17.4]. For the purposes of this analysis, NMFS adopts this definition of harassment.

For some studies, ESA-listed fish will be observed in-water (e.g., snorkel surveys). Direct observation is the least disruptive and simplest method for determining presence/absence of the species and estimating the relative abundance. Typically, a cautious observer is effective in obtaining data without disrupting the normal behavior of a fish. Fry and juveniles frightened by the water turbulence and sound created by observers are likely to seek temporary refuge behind rocks, vegetation, and deep water areas. In extreme cases, some individuals may temporarily leave the particular pool or habitat type when observers are in their area. Researchers minimize disturbance to fish by moving through streams slowly thus allowing ample time for fish to reach escape cover. During some research activities, redds may be visually inspected, but no redds will be walked on. Harassment is the primary form of take associated with these observation activities, and few if any injuries or deaths are expected to occur. Based on prior research experience, the proposed observation/harassment of ESA-listed fish should not have any long-term, adverse effects on any of the species' populations or the species as a whole.

Capture/Handling

All sampling, handling, and tagging procedures carry an inherent potential for causing stress, disease transmission, injury, or death. Based on prior experience with the research techniques and protocols to be used to conduct the scientific research, unintentional mortality of ESA-listed juvenile salmon and steelhead expected to occur from the capture and handling procedures is not likely to exceed five percent of the fish subjected to handling, and in most cases, unintentional mortality of ESA-listed juvenile fish will not exceed two percent. Based on prior experience with the research techniques and protocols to be used to conduct the scientific research, unintentional mortality of ESA-listed adult salmon and steelhead expected to occur from the capture and handling procedures is not likely to exceed one percent of the fish subjected to handling. ESA-listed adult and juvenile fish indirect mortalities may be retained as reference specimens or used for analytical research purposes.

The handling process is likely to cause some stress on ESA-listed fish. Typically, fish recover rapidly from handling procedures. The primary factors that contribute to stress and mortality from handling are excessive doses of anesthetic, differences in water temperatures, dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Wet hands and keeping fish submersed while acquiring scientific information will minimize scale and slime removal. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18°C or dissolved oxygen is below saturation. Also, stress can occur if there are more than a few degrees difference in water temperature between the stream/river and the holding tank. Study protocols would include only handling fish during appropriate water temperatures to avoid adding any additional stress and ensuring revival prior to release.

Fish can experience stress and injury from overcrowding in traps if the traps are not emptied on a regular basis. Debris buildup at traps can also cause injuries and mortalities if the traps are not monitored and cleared on a regular basis. Traps are proposed to be checked each morning or more frequently as necessitated by increased water flows or debris movement. Traps would not be fished during time periods when they cannot be adequately checked and maintained. Checking traps during the morning would ensure handling fish during the coolest water temperatures to reduce stress and potential mortality.

Fish that are transferred to holding tanks could experience trauma if care is not taken in the transfer process. Fish will be transferred from the traps to recovery tanks by the use of dip nets or sanctuary nets. The use of nets avoids human handling and reduces the potential for descaling or other netting injuries and potential post-handling mortality. All researchers that propose to handle and transfer fish will be required to use sanctuary nets that hold water during transfer whenever necessary to prevent the added stress of an out-of-water transfer.

Tagging/Marking

The use of PIT tags, coded-wire tags, fin clips, and radio tags are common to many scientific research efforts involving ESA-listed anadromous fish species. All tagging and marking procedures have an inherent potential to stress, injure, or even kill the test fish.

A PIT tag is an electronic device that relays signals to a radio receiver. It allows salmonids to be identified whenever they pass a location containing such a receiver (e.g., any of several dams) without researchers having to handle the fish again. The tag is inserted into the body cavity of the fish just in front of the pelvic girdle. The tagging procedure requires that the fish be captured and extensively handled, therefore, any researchers using PIT tags are required to use standardized methods and techniques to ensure that the operation takes place in the safest possible manner. In general, tagging operations take place where there is cold water, a carefully controlled environment for administering anesthesia, sanitary conditions, quality control checking, and a carefully regulated holding environment where the fish are allowed to recover.

PIT tags have very little effect on growth, mortality, or behavior. The few reported studies of PIT tags have shown no effect on growth or survival (Prentice *et al.* 1987; Jenkins and Smith 1990; Prentice *et al.* 1990). For example, in a study between the tailraces of Lower Granite and McNary Dams (225 km), Hockersmith *et al.* (2000) concluded that the performance of yearling chinook salmon was not adversely affected by gastrically- or surgically-implanted sham radio tags or PIT tags. Additional studies have shown that growth rates among PIT-tagged Snake River fall chinook salmon juveniles in 1992 (Rondorf and Miller 1994) were similar to growth rates for salmon that were not tagged (Conner *et al.* 2001). Prentice and Park (1984) also found that PIT-tagging did not substantially affect survival in juvenile salmonids.
The use of one needle to tag multiple fish has the potential to transmit diseases to the fish that are tagged. To reduce potential risks to ESA-listed fish, all Permit Holders will be required to use state-of-the-art handling and tagging techniques including the use of a sterilized needle for each individual injection to minimize the lateral transfer of pathogens.

Coded-wire tags (CWTs) are made of magnetized, stainless-steel wire. They bear distinctive notches that can be coded for such data as species, brood year, hatchery of origin, and so forth

(Nielson 1992). The tags are intended to remain within the animal indefinitely, consequently making them ideal for making long-term, population-level assessments of Pacific Northwest salmon. The tag is injected into the nasal cartilage of a salmon and therefore causes little direct tissue damage (Bergman *et al.* 1968; Bordner *et al.* 1990). The conditions under which CWTs may be inserted are similar to those required for applying PIT tags. A major advantage to using CWTs is the fact that they have a negligible effect on the biological condition or response of tagged salmon; however, if the tag is placed too deeply in the snout of a fish, it may kill the fish, reduce its growth, or damage olfactory tissue (Fletcher *et al.* 1987; Peltz and Miller 1990). This latter effect can create problems for species like salmon because they use olfactory clues to guide their spawning migrations (Morrison and Zajac 1987).

In order for researchers to be able to determine later (after the initial tagging) which fish possess CWTs, it is necessary to mark the fish externally—usually by clipping the adipose fin—when the CWT is implanted (see text below for information on fin clipping). One major disadvantage to recovering data from CWTs is that the fish must be killed in order for the tag to be removed. However, this is not a significant problem because researchers generally recover CWTs from salmon that have been taken during the course of commercial and recreational harvest (and are therefore already dead).

The other primary method for tagging fish is to implant them with radio tags. There are two main ways to accomplish this and they differ in both their characteristics and consequences. First, a tag can be inserted into a fish's stomach by pushing it past the esophagus with a plunger. Stomach insertion does not cause a wound and does not interfere with swimming. This technique is benign when salmon are in the portion of their spawning migrations during which they do not feed (Nielson 1992). In addition, stomach tags allow faster post-tagging recovery and interfere less with normal behavior than do tags attached in other ways.

The second method for implanting radio tags is to place them within the body cavities of (usually juvenile) salmonids. These tags do not interfere with feeding or movement. However, the tagging procedure is difficult, requiring considerable experience and care (Nielson 1992). Because the tag is placed within the body cavity, it is possible to injure a fish's internal organs. Infections of the sutured incision and the body cavity itself are also possible, especially if the tag and incision are not treated with antibiotics (Chisholm and Hubert 1985; Mellas and Haynes 1985). Fish with internal radio tags often die at higher rates than fish tagged by other means because radio tagging is a complicated and stressful process. Mortality is both acute (occurring during or soon after tagging) and delayed (occurring long after the fish have been released into the environment). Acute mortality is caused by trauma induced during capture, tagging, and release. It can be reduced by handling fish as gently as possible. Delayed mortality occurs if the tag or the tagging procedure harms the animal in direct or subtle ways. Tags may cause wounds that do not heal properly, may make swimming more difficult, or may make tagged animals more vulnerable to predation (Howe and Hoyt 1982; Matthews and Reavis 1990; Moring 1990). Tagging may also reduce fish growth by increasing the energetic costs of swimming and maintaining balance. As with the other forms of tagging and marking, researchers will keep the harm caused by radio tagging to a minimum by following the permit conditions described in the

Description of the Proposed Actions section above, as well as any other permit-specific requirements.

Fin clipping is the process of removing part or all of one or more fins to alter a fish's appearance and thus make it identifiable. When entire fins are removed, it is expected that they will never grow back. Alternatively, a permanent mark can be made when only a part of the fin is removed or the end of a fin or a few fin rays are clipped. Although researchers have used all fins for marking at one time or another, the current preference is to clip the adipose, pelvic, or pectoral fins. Marks can also be made by punching holes or cutting notches in fins, severing individual fin rays (Welch and Mills 1981), or removing single prominent fin rays (Kohlhorst 1979). Many studies have examined the effects of fin clips on fish growth, survival, and behavior. The results of these studies are somewhat variable; however, it can be said that fin clips do not generally alter fish growth. Studies comparing the growth of clipped and unclipped fish generally have shown no differences between them (e.g., Brynildson and Brynildson 1967). Moreover, wounds caused by fin clipping usually heal quickly—especially those caused by partial clips.

Mortality among fin-clipped fish is also variable. Some immediate mortality may occur during the marking process, especially if fish have been handled extensively for other purposes (e.g., stomach sampling). Delayed mortality depends, at least in part, on fish size; small fishes have often been found to be susceptible to it and Coble (1967) suggested that fish shorter than 90 mm are at particular risk. The degree of mortality among individual fishes also depends on which fin is clipped. Studies show that adipose- and pelvic-fin-clipped coho salmon fingerlings have a 100 percent recovery rate (Stolte 1973). Recovery rates for steelhead were 60 percent when the adipose fin was clipped and 52 percent when the pelvic fin was clipped and dropped markedly when the pectoral, dorsal, and anal fins were clipped (Nicola and Cordone 1973). Clipping the adipose and pelvic fins probably kills fewer fish because these fins are not as important as other fins for movement or balance (McNeil and Crossman 1979). Mortality is generally higher when the major median and pectoral fins are clipped. Mears and Hatch (1976) showed that clipping more than one fin may increase delayed mortality. Regardless, any time researchers clip or remove fins, it is necessary that the fish be handled. Therefore, the same safe and sanitary conditions required for tagging operations also apply to clipping activities.

All tagging and handling procedures require anesthetics to calm the fish subjected to handling, especially if the fish are to be handled out-of-water. Because temperature, turbidity, fish condition, and other factors can alter a fish's reaction to an anesthetic, the concentration of an anesthetic will be adjusted for the ambient environmental conditions based on the manufacturers specifications to achieve proper sedation and minimize the risk of harming fish. Dosages will also vary by body size but would be kept at minimum levels. After the collection of biological data, captured fish will be allowed to fully recover before being released back into the stream and will be released only in slow water areas.

<u>Electrofishing</u>

The effects of electrofishing on ESA-listed anadromous salmon and steelhead within the action areas would be limited to the direct and indirect effects of exposure to an electric field, capture by netting, holding captured fish in aerated tanks, and the effects of handling associated with transferring the fish back to the river. It has long been recognized that overexposure of fish to a strong electric field can cause injury and death. The amount of unintentional mortality attributable to electrofishing may vary widely depending on the equipment used, the settings on the equipment, and the expertise and experience of the technician. The effects of electrofishing on adults can be severe. Spinal injuries in adult salmonids from forced muscle contraction have been documented. Sharber and Carothers (1988) reported that electrofishing caused a 50 percent mortality level in adult rainbow trout. Habera *et al*. (1996) reported overall mortality rates of 20 percent for rainbow trout less than 100 mm in length and 6 percent for those over 100 mm using a three pass depletion method. Habera *et al*. also reported an overall injury rate of 6 percent. The long-term effects on both juvenile and adult salmon and steelhead are not well understood, but it is assumed that most impacts from electrofishing occur at the time of sampling.

Most of the studies on the effects of electrofishing on fish have been conducted on adult fish greater than 300 mm in length (Dalbey *et al.* 1996). The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injury is substantially lower than in large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers 1988) and may therefore be subject to lower injury rates (e.g., Hollender and Carline 1994, Dalbey *et al.* 1996, Thompson *et al.* 1997). The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and Carothers 1988, McMichael 1993, Dalbey *et al.* 1996, Dwyer and White 1997). Continuous direct current (DC) or low-frequency ($\leq$30 Hz) pulsed DC have been recommended for electrofishing (Fredenberg 1992, Snyder 1992, 1995, Dalbey *et al.* 1996) because lower spinal injury rates, particularly in salmonids, occur with these waveforms (Fredenberg 1992, Taube 1992, McMichael 1993, Sharber *et al.* 1994, Dalbey *et al.* 1996). Only a few recent studies have examined the long-term effects of electrofishing on survival and growth of salmonids (Ainslie *et al.* 1998, Dalbey *et al.* 1996, Taube 1992). These studies indicate that although relatively large percentages of the fish suffered spinal injury, long-term mortality was very low. However, severely injured fish grew at slower rates or showed no growth compared to control or minimally damaged fish (Dalbey *et al.* 1996).

The potential for unexpected injuries or mortalities to ESA-listed fish as a result of the use of electrofishing will be mitigated in a number of ways. NMFS' electrofishing guidelines (NMFS 2000c) will be followed. These guidelines include training field crews in observing animals for signs of stress and how to adjust electrofishers to minimize stress. Electrofishing is used only when other survey methods are not feasible. All areas for stream and special needs surveys are visually searched for fish prior to the application of an electrical current. Electrofishing is not done in the vicinity of redds or where fish are visually observed. All people operating electroshocking equipment are trained by qualified personnel to be familiar with equipment handling, settings, care, and safety. Operators work in pairs to increase visual detection of fish and fish identification with minimal or no netting. Working in pairs also allows the netter to intercept and net fish before they are attracted to water with higher electrical fields. Only DC units will be used, and the equipment will be regularly maintained to ensure proper operating condition. Voltage, pulse width, and rate will be kept at minimal levels. At the start of every electrofishing session, water conductivity will be tested, and settings will be set at minimum rates. Settings will be kept below levels which cause immobilization. Due to the low settings used, shocked fish are normally instantaneously revived. Fish requiring reviving will receive immediate, adequate care.

The preceding discussion focused on the effects of using a backpack unit for electrofishing and the ways those effects will be mitigated. It should be noted, however, that in larger streams and rivers, electrofishing units are sometimes mounted on boats. These units often use more current than backpack electrofishing equipment because they need to cover larger (and deeper) areas and, as a result, can have a greater impact on fish. In addition, the environmental conditions in larger, more turbid streams can limit the researchers' ability to minimize impacts on fish. For example, in areas of lower visibility it is difficult for researchers to detect the presence of adults and thereby take steps to avoid them. Because of its greater potential to harm fish, and because NMFS has not published appropriate guidelines, boat electrofishing has not been given a general authorization under NMFS' recent ESA section 4(d) rules. However, it is expected that guidelines for safe boat electrofishing will be in place in the near future. All researchers intending to use boat electrofishing will use all the means at their disposal to ensure that a minimum number of fish are harmed (these means will include a number of long-established protocols that will eventually be incorporated into NMFS' guidelines).

Sacrifice

In some instances, it is necessary to kill a captured fish in order to gather whatever data a study is designed to produce. In such cases, the sacrificed fish, if juveniles, are forever removed from the ESU's gene pool; if the fish are adults, the effect depends upon whether they are killed before or after they have a chance to spawn. If they are killed after they spawn, there is very little overall effect. Essentially, it amounts to removing the nutrients their bodies would have provided to the spawning grounds. If they are killed before they spawn, not only are they removed from the ESU, but so are all their potential progeny. Thus, killing pre-spawning adults has the greatest potential to affect the ESU and, because of this, NMFS rarely allows it to happen. And, in almost every instance where it is allowed, the adults are stripped of sperm and eggs so their progeny can be raised in a controlled environment such as a hatchery—thereby greatly decreasing the potential harm posed by sacrificing the adults. Clearly, there is no way to mitigate the effects of outrightly sacrificing a fish.

Permit-Specific Effects

Permit Modifications/Amendments

Permit 1141, Modification 3

The maximum annual takes of UCR spring chinook salmon juveniles with the potential to result in mortalities and the estimated maximum lethal takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Species Total
Capture, Tag/Mark, Release	2,380	0	2,380
Total non-lethal take	**2,380**	**0**	**2,380**
Direct Mortality	20	0	20
Indirect Mortality	48	0	48
Total lethal take	**68**	**0**	**68**

The annual non-lethal and lethal takes of juvenile, endangered, artificially-propagated, UCR spring chinook salmon due to Grant County PUD's proposed research activities are not likely to result in a substantially greater impact to any one hatchery population over another since the probability of being taken is equivalent for all population types at Wanapum and Priest Rapids Dams. Also, the proposed activities are not intended to emphasize one population type over another. According to the juvenile salmon outmigration estimates produced by NMFS' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of artificially-propagated, UCR spring chinook salmon juveniles expected to reach Wanapum Dam in 2002 will be 394,389. If the estimated production for the 2002 juvenile chinook salmon outmigration season is assumed to be typical for future years, NMFS does not believe that the loss of up to 68 juvenile, endangered, artificially-propagated, UCR spring chinook salmon annually (2 percent indirect mortality level + up to 20 direct mortalities) will impact the viability of the spring chinook salmon populations that originate upstream of Wanapum Dam.

Grant County PUD's personnel will implement the following measures to minimize injuries and mortalities: All fish handled will be held in flowing river water. When anesthetized, fish will remain in solution until they can be handled. All fish will be allowed to recover before being released. All equipment and procedures are designed to minimize adverse effects on fish. Dipnets are made from soft nylon, all fasteners are coated with silicone, and any contact surfaces are maintained smooth and free of burrs and debris. Anesthetized fish are placed into a surgical cradle lined with soft wet cloth to prevent injury. Back-up oxygen and water flow systems will be installed in the event there are problems with the main systems (Grant County PUD 1998). NMFS considers these to be adequate measures to minimize the impacts to the ESA-listed fish.

Permit 1322, Modification 1

The maximum annual takes of UCR spring chinook salmon juveniles with the potential to result in mortalities and the estimated maximum lethal takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, Handle, Release	64	2	66

Total non-lethal take	**64**	**2**	**66**
Direct Mortality	37	1	38
Indirect Mortality	1	0	1
Total lethal take	**38**	**1**	**39**

The annual non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon associated with NWFSC's proposed scientific research will occur in the estuary of the Columbia River. NWFSC's personnel are not able to distinguish between the different populations of UCR spring chinook salmon when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of endangered UCR spring chinook salmon. Because of the uncertainty, this analysis is not sensitive enough to evaluate the effects due to the proposed activities on endangered UCR spring chinook salmon at the population level. The analysis for this permit action assumes that the status of each affected population of UCR spring chinook salmon is the same as the ESU as a whole.

For the purpose of this analysis, NWFSC's proposed takes are compared with the total ESA-listed UCR spring chinook salmon juveniles estimated to emigrate to Tongue Point in 2002, which is located in the Columbia River estuary. The juvenile, endangered, naturally-produced, UCR spring chinook salmon outmigration runsize estimate at Tongue Point under the transportation with spill scenario in 2002 will be 1,140,302 and the juvenile, endangered, artificially-propagated, UCR spring chinook salmon outmigration runsize estimate at Tongue Point under the transportation with spill scenario in 2002 will be 286,759, as calculated from Schiewe 2002. If the estimates for the 2002 juvenile chinook salmon outmigration season is assumed to be typical for future years, NMFS does not believe that the loss of up to 1 juvenile, endangered, naturally-produced, UCR spring chinook salmon and the loss of up to 38 juvenile, endangered, artificially-propagated, UCR spring chinook salmon annually (1 percent indirect mortality level + direct mortalities) will impact the viability of the spring chinook salmon populations that originate in the upper Columbia River region.

NWFSC proposes to use the following measures to minimize and mitigate take: All possible steps will be taken to remove non-targeted fish from the seines and nets as quickly and gently as possible. Fish are immediately placed into estuarine water with aeration. To minimize the stress to all caught fish, the cod end of the beach seine and trapnet will never be completely out of the water. Dip nets with reservoir bags will be used to dip fish out of the seine to allow fish to remain in estuarine water when handled. If catches appear to be larger than anticipated, the duration and size of the hauls can be controlled to reduce catch volume (NWFSC 2001). NMFS considers these to be adequate measures to minimize the impacts to the ESA-listed fish.

Permit 1335, Amendment

The maximum annual takes of UCR spring chinook salmon juveniles with the potential to result in mortalities and the estimated maximum lethal takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, Handle, Release	0	300	300
Total non-lethal take	**0**	**300**	**300**
Indirect Mortality	0	9	9
Total lethal take	**0**	**9**	**9**

The annual non-lethal and lethal takes of juvenile, endangered, naturally-produced, UCR spring chinook salmon associated with USFS' proposed scientific research will occur in the upper Methow River Basin in the Okanogan National Forest. Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR spring chinook salmon juveniles from the Methow River in 2002 will be 262,201 (unpublished data, Yakima Indian Nation). Given these production numbers, NMFS does not believe that the annual loss of up to 9 juvenile, endangered, naturally-produced, UCR spring chinook salmon from the upper Methow River populations (3 percent indirect mortality level) will impact the viability of those populations. Percent mortality of juvenile, naturally-produced, UCR spring chinook salmon associated with USFS' proposed research activities is **0.003 percent (9/262,201)**.

The maximum annual takes of UCR steelhead juveniles with the potential to result in mortalities and the estimated maximum lethal takes are enumerated below:

UCR Steelhead

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, Handle, Release	0	500	500
Total non-lethal take	**0**	**500**	**500**
Indirect Mortality	0	15	15
Total lethal take	**0**	**15**	**15**

The annual non-lethal and lethal takes of juvenile, endangered, naturally-produced, UCR steelhead associated with USFS' proposed scientific research will occur in the upper Methow River Basin in the Okanogan National Forest. Based on last years research efforts (adult escapement, redd counts, fecundity, survival information), the estimated total production of ESA-listed, naturally-produced, UCR steelhead juveniles from the Methow River in 2002 will be 154,251 (unpublished data, Yakima Indian Nation). Given these numbers, NMFS does not believe that the annual loss of up to 15 juvenile, endangered, naturally-produced, UCR steelhead from the upper Methow River populations (3 percent indirect mortality level) will impact the viability of those populations. Percent mortality of juvenile, naturally-produced, UCR steelhead associated with USFS' proposed research activities is **0.01 percent (15/154,251)**.

USFS proposes to use the following measures to minimize and mitigate take: All electrofishing will be performed by experienced personnel or under their direct supervision. For every longitudinal transect, the single pass method will be employed, which will minimize the amount of injuries. Streams above 18° C and below 4° C will not be sampled. Streams with less than 0.3 meters of visibility will not be sampled. A conductivity and temperature reading will be taken before electrofishing is started and the electrofishing unit will be adjusted accordingly. Electrofishing will not be performed if eggs or alevin are suspected to be present in gravels and/or if adult spawners may be present. Whenever possible, USFS will coordinate the sampling efforts with other agencies to avoid duplicate sampling (USFS 2001). NMFS considers these to be adequate measures to minimize the impacts to the ESA-listed fish.

Permit 1345, Amendment

The maximum annual takes of UCR spring chinook salmon adults and juveniles with the potential to result in mortalities are enumerated below:

UCR Spring Chinook Salmon

Type of Take	UCR Adults	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, Handle, Release	1	3	4	8
Total non-lethal take	**1**	**3**	**4**	**8**
Indirect Mortality	0	0	0	0
Total lethal take	**0**	**0**	**3**	**3**

The annual non-lethal takes of adult and juvenile, endangered, UCR spring chinook salmon associated with WDFW's research activities will occur in the mainstem rivers and tributaries in the upper Columbia River region in Washington. WDFW's researchers will not be able to distinguish between the different populations of UCR spring chinook salmon when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of endangered UCR spring chinook salmon. Because of the uncertainty, this analysis is not sensitive enough to evaluate the effects on endangered UCR spring chinook salmon at the population level. The analysis for this permit action assumes that the status of each affected population of UCR spring chinook salmon is the same as the ESU as a whole.

For the purpose of this analysis, WDFW's annual non-lethal take of adult, endangered, UCR spring chinook salmon associated with its proposed scientific research is compared with a recent five-year average for the species' annual escapement for the ESU as a whole. Adult escapement numbers at Rock Island Dam are used for this analysis since the majority of the species' tributaries of origin are upstream of this dam. According to the Fish Passage Center, the most recent five-year average for the annual adult escapement of UCR spring chinook salmon to Rock Island Dam (1997-2001) is 13,457 (FPC 2002). These fish represented a combination of naturally-produced adults and adults that originated from the hatchery supplementation programs in the upper Columbia River region overseen by WDFW. No mortalities of adult, endangered, UCR spring chinook salmon are expected by WDFW. If the five-year average for the annual adult escapement of UCR spring chinook salmon to Rock Island Dam is assumed to be typical for future years, NMFS does not believe that the annual non-lethal take of up to 1 adult, endangered, UCR spring chinook salmon associated with WDFW's research activities will impact the viability of the spring chinook salmon populations that originate in the upper Columbia River region.

For the purpose of this analysis, WDFW's proposed annual take of UCR spring chinook salmon juveniles is compared with the 2002 juvenile spring chinook salmon outmigration estimates at Rock Island Dam since the majority of the species' tributaries of origin are upstream of this dam. According to the juvenile salmon outmigration estimates produced by NMFS' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of naturally-produced, UCR spring chinook salmon juveniles expected to reach Rock Island Dam in 2002 will be 1,843,938 and the total number of artificially-propagated, UCR spring chinook salmon juveniles expected to reach Rock Island Dam in 2002 will be 438,210. If the estimated production for the 2002 juvenile spring chinook salmon outmigration season is assumed to be typical for future years, NMFS does not believe that the annual lethal take of up to 3 endangered, naturally-produced, UCR spring chinook salmon, annual non-lethal take of up to 4 juvenile, endangered, naturally-produced, UCR spring chinook salmon, and up to 3 juvenile, endangered, artificially-propagated, UCR spring chinook salmon associated with WDFW's research activities will impact the viability of the spring chinook salmon populations that originate upstream of Rock Island Dam.

The maximum annual takes of UCR steelhead adults and juveniles with the potential to result in mortalities are enumerated below:

UCR Steelhead

Type of Take	UCR Adults	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, Handle, Release	1	1	2	4
Total non-lethal take	**1**	**1**	**2**	**4**
Indirect Mortality	0	0	0	0
Total lethal take	**0**	**0**	**0**	**0**

The annual non-lethal takes of adult and juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with WDFW's research activities will occur in the mainstem rivers and tributaries in the upper Columbia River region in Washington. WDFW's researchers will not be able to distinguish between the different populations of UCR steelhead when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of endangered UCR steelhead. Because of the uncertainty, this analysis is not sensitive enough to evaluate the effects on endangered UCR steelhead at the population level. The analysis for this permit action assumes that the status of each affected population of UCR steelhead is the same as the ESU as a whole.

For the purpose of this analysis, WDFW's annual non-lethal take of adult, endangered, UCR steelhead associated with its proposed scientific research is compared with a recent five-year average for the species' annual escapement for the ESU as a whole. Adult escapement numbers at Rock Island Dam are used for this analysis since the majority of the species' tributaries of origin are upstream of this dam. According to the Fish Passage Center, the most recent five-year average for the annual adult escapement of UCR steelhead to Rock Island Dam (1997-2001) is 11,633 (FPC 2002). These fish represented a combination of naturally-produced adults and adults that originated from the hatchery supplementation programs in the upper Columbia River region overseen by WDFW. No mortalities of adult, endangered, UCR steelhead are expected by WDFW. If the five-year average for the annual adult escapement of UCR steelhead to Rock Island Dam is assumed to be typical for future years, NMFS does not believe that the annual non-lethal take of up to 1 adult, endangered, UCR steelhead associated with WDFW's research activities will impact the viability of the steelhead populations that originate in the upper Columbia River region.

For the purpose of this analysis, WDFW's proposed annual take of UCR steelhead juveniles is compared with the 2002 juvenile steelhead outmigration estimates at Rock Island Dam since the majority of the species' tributaries of origin are upstream of this dam. According to the juvenile steelhead outmigration estimates produced by NMFS' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of naturally-produced, UCR steelhead juveniles expected to reach Rock Island Dam in 2002 will be 218,400 and the total number of artificially-propagated, UCR steelhead juveniles expected to reach Rock Island Dam in 2002 will be 738,082. If the estimated production for the 2002 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS does not believe that the annual non-lethal take of up to 2 juvenile, endangered, naturally-produced, UCR steelhead and up to 1 juvenile, endangered, artificially-propagated, UCR steelhead associated with WDFW's research activities will impact the viability of the steelhead populations that originate upstream of Rock Island Dam.

WDFW proposes to use the following measures to minimize and mitigate take: Fish captured using boat electrofishing are not anesthetized and are quickly weighed and measured for length. The fish recover immediately and are returned alive to the area from which they were netted. The surveys are usually conducted in the backwater sloughs, oxbow lakes, and ponds rather than in the main channel of a river system. Survey timing, warmer water temperatures, and limiting the sampling to shallow shoreline sections greatly limits the number of resident and anadromous salmonids taken with boat electrofishing gear (WDFW 2001). NMFS considers these to be adequate measures to minimize the impacts to the ESA-listed fish.

New Permits

Permit 1366

The maximum annual takes of UCR spring chinook salmon juveniles with the potential to result in mortalities and the estimated maximum lethal takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, Handle, Release	0	20	20
Total non-lethal take	**0**	**20**	**20**
Direct Mortality	12	20	32
Indirect Mortality	0	1	1
Total lethal take	**12**	**21**	**33**

The annual non-lethal and lethal takes of juvenile, endangered, UCR spring chinook salmon associated with OCFWRU's research activities will occur at McNary and Bonneville Dams on the mainstem lower Columbia River. OCFWRU's researchers will not be able to distinguish between the different populations of UCR spring chinook salmon when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of UCR spring chinook salmon. Because of the uncertainty, this analysis is not sensitive enough to evaluate the effects at the population level. The analysis for this permit action assumes that the status of each affected population of UCR spring chinook salmon is the same as the ESU as a whole.

For the purpose of this analysis, OCFWRU's proposed annual mortality level of UCR spring chinook salmon juveniles is compared with the 2002 juvenile spring chinook salmon outmigration estimates at McNary Dam. According to the juvenile salmon outmigration estimates produced by NMFS' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of naturally-produced, UCR spring chinook salmon juveniles expected to reach McNary Dam in 2002 under the transportation with spill scenario will be 1,344,231 and the total number of artificially-propagated, UCR spring chinook salmon juveniles expected to reach McNary Dam in 2002 under the transportation with spill scenario will be 319,455. If the estimated production for the 2002 juvenile spring chinook salmon outmigration season is assumed to be typical for future years, NMFS does not believe that the annual lethal take of up to 21 juvenile, endangered, naturally-produced, UCR spring chinook salmon and up to 12 juvenile, endangered, artificially-propagated, UCR spring chinook salmon associated with OCFWRU's research activities (3 percent indirect mortality level + direct mortalities) will impact the viability of the spring chinook salmon populations that originate in the upper Columbia River region.

The maximum annual takes of UCR steelhead juveniles with the potential to result in mortalities and the estimated maximum lethal takes are enumerated below:

UCR Steelhead

Type of Take	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, Handle, Release	35	0	35
Total non-lethal take	**35**	**0**	**35**
Direct Mortality	18	93	111
Indirect Mortality	1	0	1
Total lethal take	**19**	**93**	**112**

The annual non-lethal and lethal takes of juvenile, endangered, UCR steelhead associated with OCFWRU's research activities will occur at McNary and Bonneville Dams on the mainstem lower Columbia River. OCFWRU's researchers will not be able to distinguish between the different populations of UCR steelhead when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of UCR steelhead. Because of the uncertainty, this analysis is not sensitive enough to evaluate the effects at the population level. The analysis for this permit action assumes that the status of each affected population of UCR steelhead is the same as the ESU as a whole.

For the purpose of this analysis, OCFWRU's proposed annual mortality level of UCR steelhead juveniles is compared with the 2002 juvenile steelhead outmigration estimates at McNary Dam. According to the juvenile steelhead outmigration estimates produced by NMFS' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of naturally-produced, UCR steelhead juveniles expected to reach McNary Dam in 2002 under the transportation with spill scenario will be 159,214 and the total number of artificially-propagated, UCR steelhead juveniles expected to reach McNary Dam in 2002 under the transportation with spill scenario will be 619,242. If the estimated production for the 2002 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS does not believe that the annual lethal take of up to 93 juvenile, endangered, naturally-produced, UCR steelhead and up to 19 juvenile, endangered, artificially-propagated, UCR steelhead associated with OCFWRU's research activities (3 percent indirect mortality level + direct mortalities) will impact the viability of the steelhead populations that originate in the upper Columbia River region.

OCFWRU proposes to use the following measures to minimize and mitigate take: Any indirect mortalities of ESA-listed juvenile fish will be used in place of direct mortalities. All non-targeted fish will be released after no more than 24 hours in the holding tanks. No additional handling will occur. Sampling procedures allow researchers to select only those fish suitable for the research. Fish are kept in water at all times (OCFWRU 2002). NMFS considers these to be adequate measures to minimize the impacts to the ESA-listed fish.

Permit 1386

The maximum annual takes of UCR spring chinook salmon adults and juveniles with the potential to result in mortalities and the estimated maximum lethal takes are enumerated below:

UCR Spring Chinook Salmon

Type of Take	UCR Adults	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, Handle, Release	20	50	50	120
Total non-lethal take	**20**	**50**	**50**	**120**
Indirect Mortality	0	1	1	2
Total lethal take	**0**	**1**	**1**	**2**

The annual non-lethal and lethal takes of adult and juvenile, endangered, UCR spring chinook salmon associated with WDOE's research activities will occur in various rivers and tributaries in the upper Columbia River Basin, including the mainstem Columbia River. WDOE's researchers will not be able to distinguish between the different populations of UCR spring chinook salmon when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of UCR spring chinook salmon. Because of the uncertainty, this analysis is not sensitive enough to evaluate the effects at the population level. The analysis for this permit action assumes that the status of each affected population of UCR spring chinook salmon is the same as the ESU as a whole.

For the purpose of this analysis, WDOE's annual non-lethal take of adult, endangered, UCR spring chinook salmon associated with its proposed scientific research is compared with a recent five-year average for the species' annual escapement for the ESU as a whole. Adult escapement numbers at Rock Island Dam are used for this analysis since the majority of the species' tributaries of origin are upstream of this dam. According to the Fish Passage Center, the most recent five-year average for the annual adult escapement of UCR spring chinook salmon to Rock Island Dam (1997-2001) is 13,457 (FPC 2002). These fish represented a combination of naturally-produced adults and adults that originated from the hatchery supplementation programs in the upper Columbia River region overseen by WDFW. No mortalities of adult, endangered, UCR spring chinook salmon are expected by WDOE. If the five-year average for the annual adult escapement of UCR spring chinook salmon to Rock Island Dam is assumed to be typical for future years, NMFS does not believe that the annual non-lethal take of up to 20 adult, endangered, UCR spring chinook salmon associated with WDOE's research activities will impact the viability of the spring chinook salmon populations that originate in the UCR region.

For the purpose of this analysis, WDOE's proposed annual mortality level of UCR spring chinook salmon juveniles is compared with the 2002 juvenile spring chinook salmon outmigration estimates at Rock Island Dam since the majority of the species' tributaries of origin are upstream of this dam. According to the juvenile salmon outmigration estimates produced by NMFS' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of naturally-produced, UCR spring chinook salmon juveniles expected to reach Rock Island Dam in 2002 will be 1,843,938 and the total number of artificially-propagated, UCR spring chinook salmon juveniles expected to reach Rock Island Dam in 2002 will be 438,210. If the estimated production for the 2002 juvenile spring chinook salmon outmigration season is assumed to be typical for future years, NMFS does not believe that the annual lethal take of up to 1 juvenile, endangered, naturally-produced, UCR spring chinook salmon and up to 1 juvenile, endangered, artificially-propagated, UCR spring chinook salmon associated with WDOE's research activities (2 percent indirect mortality level) will impact the viability of the spring chinook salmon populations that originate upstream of Rock Island Dam.

The maximum annual takes of UCR steelhead adults and juveniles with the potential to result in mortalities and the estimated maximum lethal takes are enumerated below:

UCR Steelhead

Type of Take	UCR Adults	Artificially-Propagated UCR Juveniles	Naturally-Spawned UCR Juveniles	Totals for Species
Capture, Handle, Release	20	50	50	120
Total non-lethal take	**20**	**50**	**50**	**120**
Indirect Mortality	0	1	1	2
Total lethal take	**0**	**1**	**1**	**2**

The annual non-lethal and lethal takes of adult and juvenile, endangered, UCR steelhead associated with WDOE's research activities will occur in various rivers and tributaries in the upper Columbia River Basin, including the mainstem Columbia River. WDOE's researchers will not be able to distinguish between the different populations of UCR steelhead when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed action on specific populations of UCR steelhead. Because of the uncertainty, this analysis is not sensitive enough to evaluate the effects at the population level. The analysis for this permit action assumes that the status of each affected population of UCR steelhead is the same as the ESU as a whole.

For the purpose of this analysis, WDOE's annual non-lethal take of adult, endangered, UCR steelhead associated with its proposed scientific research is compared with a recent five-year average for the species' annual escapement for the ESU as a whole. Adult escapement numbers at Rock Island Dam are used for this analysis since the majority of the species' tributaries of origin are upstream of this dam. According to the Fish Passage Center, the most recent five-year average for the annual adult escapement of UCR steelhead to Rock Island Dam (1997-2001) is 11,633 (FPC 2002). These fish represented a combination of naturally-produced adults and adults that originated from the hatchery supplementation programs in the upper Columbia River region overseen by WDFW. No mortalities of adult, endangered, UCR steelhead are expected by WDOE. If the five-year average for the annual adult escapement of UCR steelhead to Rock Island Dam is assumed to be typical for future years, NMFS does not believe that the annual non-lethal take of up to 20 adult, endangered, UCR steelhead associated with WDOE's research activities will impact the viability of the steelhead populations that originate in the UCR region.

For the purpose of this analysis, WDOE's proposed annual mortality level of UCR steelhead juveniles is compared with the 2002 juvenile steelhead outmigration estimates at Rock Island Dam since the majority of the species' tributaries of origin are upstream of this dam. According to the juvenile steelhead outmigration estimates produced by NMFS' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of naturally-produced, UCR steelhead juveniles expected to reach Rock Island Dam in 2002 will be 218,400 and the total number of artificially-propagated, UCR steelhead juveniles expected to reach Rock Island Dam in 2002 will be 738,082. If the estimated production for the 2002 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS does not believe that the annual lethal take of up to 1 juvenile, endangered, naturally-produced, UCR steelhead and up to 1 juvenile, endangered, artificially-propagated, UCR steelhead associated with WDOE's research activities will impact the viability of the steelhead populations that originate upstream of Rock Island Dam.

WDOE proposes to use the following measures to minimize and mitigate take: Electrofishing activities will occur when adult salmonids are expected to be absent from the waterbody being sampled. Electrofishing efforts will adhere to NMFS and WDFW guidelines in order to minimize injuries to fish. Electrofishing will begin with straight DC current at low voltage. Should those settings be ineffective, pulsed DC at low frequencies may be used. If captured, non-target species will be netted, held in an aerated live well to aid their recovery, and released. Mesh sizes of nets should be large enough (>1") to allow juveniles to pass through unharmed (WDOE 2002). NMFS considers these to be adequate measures to minimize the impacts to the ESA-listed fish.

Cumulative Take Analysis
The cumulative take analysis for the proposed actions that occur in tributary areas is conducted by assuming that the effects to the ESA-listed fish are best represented by describing the effects to the specific populations present in the ESU. For the proposed actions that occur in the tributary areas, the relative risk to the ESA-listed species is determined by comparing the potential annual cumulative mortality level of each affected life stage (adult and juvenile) caused by the proposed actions to recent estimates of the total number of fish (for the life stage) present

in each affected population, if that information is available.[2] The maximum mortality level of each affected life stage (adult and juvenile) resulting from the proposed actions that are likely to cause mortalities (from the tables below) is then expressed as a percentage of the estimated total number of fish in each ESA-listed salmonid population affected by the proposed actions.

For the proposed actions that occur in the mainstem rivers and tributaries and migration corridor, the relative risk to the ESA-listed species is determined by comparing the potential annual cumulative mortality level of each affected life stage (adults and migrating juveniles or smolts) caused by the proposed actions to recent estimates of the total number of fish (for that life stage) present for the ESU as a whole at a specific reference point in the river system, usually at one of the hydropower dams in the vicinity of where the research activities would occur. The maximum mortality level of each affected life stage resulting from the proposed actions that are likely to cause mortalities (from the tables below) is then expressed as a percentage of the estimated total number of fish for each ESU present at the chosen reference point in the river system.

<u>UCR Spring Chinook Salmon Adults</u>
There are two proposed permit actions that involve take of adult, endangered, UCR spring chinook salmon (1345 and 1386). The proposed take levels associated with those permit actions are summarized below:

UCR Spring Chinook Salmon Adults

Proposed Permit Action	Non-lethal Take of UCR Spring Chinook Salmon Adults	Lethal Take of UCR Spring Chinook Salmon Adults
1345	1	0
1386	20	0
Totals	**21**	**0**

The total annual non-lethal take of adult, endangered, UCR spring chinook salmon associated with the proposed actions will occur in the mainstem rivers and tributaries in the UCR Basin and/or the mainstem Columbia River migration corridor. The researchers will not be able to distinguish between the different populations of UCR spring chinook salmon when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed actions on specific populations of UCR spring chinook salmon. Because of the uncertainty, this analysis is not sensitive enough to evaluate the effects at the population level. Therefore, this analysis assumes that the status of each affected population of UCR spring chinook salmon is the same as the ESU as a whole.

[2] To the extent that production information at the population level is not available, the cumulative take analysis is conducted at the river system level. To the extent that production information by river system is not available, the cumulative take analysis is conducted for the ESU as a whole.

For the purpose of this analysis, the total annual non-lethal take of adult, endangered, UCR spring chinook salmon associated with the proposed actions is compared with a recent five-year average for the species' annual escapement for the ESU as a whole. Adult escapement numbers at Rock Island Dam are used for this analysis since the majority of the species' tributaries of origin are upstream of this dam. According to the Fish Passage Center, the most recent five-year average for the annual adult escapement of UCR spring chinook salmon to Rock Island Dam (1997-2001) is 13,457 (FPC 2002). These fish represented a combination of naturally-produced adults and adults that originated from the hatchery supplementation programs in the upper Columbia River region overseen by WDFW. No mortalities of adult, endangered, UCR spring chinook salmon are expected. If the five-year average for the annual adult escapement of UCR spring chinook salmon to Rock Island Dam is assumed to be typical for future years, NMFS does not believe that the annual non-lethal take of up to 21 adult, endangered, UCR spring chinook salmon associated with the proposed actions will impact the viability of the spring chinook salmon populations that originate in the UCR region.

Percent mortality of adult, endangered, UCR spring chinook salmon associated with the proposed actions is **0.00 percent (0/13,457)**. Based on the foregoing analysis, NMFS concludes that the annual non-lethal take of up to 21 adult, endangered, UCR spring chinook salmon that is proposed to occur in the mainstem rivers and tributaries in the UCR region and/or the Columbia River migration corridor will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Adequate measures are in place to minimize the effects of the non-lethal take.

UCR Spring Chinook Salmon Juveniles

Tributary Areas

There is only one proposed permit action that involves an annual take of juvenile, endangered, UCR spring chinook salmon in the tributary areas within the species' ESU. That permit action is the proposed amendment of USFS's scientific research Permit 1335. Since there is only one permit action that involves an annual take of endangered UCR spring chinook salmon juveniles in the tributary areas within the species' ESU, the analysis of the effects of that take is sufficient at the individual permit action level (see the *Permit-Specific Effects* section above).

Mainstem Rivers and Tributaries

The following table summarizes the total annual non-lethal take that has the potential to result in lethal take (capture, handle, release; capture, tag/mark, release) and the total annual lethal take of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon associated with the proposed actions that will occur in the mainstem rivers and tributaries in the UCR region and/or the Columbia River migration corridor. Lethal take in the table includes both proposed direct mortalities and proposed indirect mortalities where applicable.

UCR Spring Chinook Salmon Juveniles - Mainstem Rivers and Tributaries

Proposed Permit Action	Non-lethal Take of Naturally-Spawned UCR Chinook Salmon Juveniles	Mortality of Naturally-Spawned UCR Chinook Salmon Juveniles	Non-lethal Take of Artificially-Propagated UCR Chinook Salmon Juveniles	Mortality of Artificially-Propagated UCR Chinook Salmon Juveniles	Total Mortalities
1141-Mod 3	0	0	2,380	68	68
1322-Mod 1	2	1	64	38	39
1345-Amd	4	0	3	0	0
1366-New	20	21	0	12	33
1386-New	50	1	50	1	2
Totals	**76**	**23**	**2,497**	**119**	**142**

The total annual non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR spring chinook salmon associated with the proposed actions will occur in the mainstem rivers and tributaries in the UCR region, the mainstem Columbia River migration corridor, and/or the Columbia River estuary. The researchers will not be able to distinguish between the different populations of UCR spring chinook salmon when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed actions on specific populations of UCR spring chinook salmon. Because of the uncertainty, this analysis is not sensitive enough to evaluate the effects at the population level. Therefore, this analysis assumes that the status of each affected population of UCR spring chinook salmon is the same as the ESU as a whole.

For the purpose of this analysis, the total annual mortality level of UCR spring chinook salmon juveniles is compared with the 2002 juvenile spring chinook salmon outmigration estimates at Rock Island Dam since the majority of the species' tributaries of origin are upstream of this dam. According to the juvenile salmon outmigration estimates produced by NMFS' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of naturally-produced, UCR spring chinook salmon juveniles expected to reach Rock Island Dam in 2002 under the transportation with spill scenario will be 1,843,938 and the total number of artificially-propagated, UCR spring chinook salmon juveniles expected to reach Rock Island Dam in 2002 under the transportation with spill scenario will be 438,210. If the estimated production for the 2002 juvenile spring chinook salmon outmigration season is assumed to be typical for future years, NMFS does not believe that the total annual lethal take of up to 23 juvenile, endangered, naturally-produced, UCR spring chinook salmon and up to 119 juvenile, endangered, artificially-propagated, UCR spring chinook salmon associated with the proposed actions will impact the viability of the spring chinook salmon populations that originate upstream of Rock Island Dam.

Percent mortality of juvenile, endangered, naturally-produced, UCR spring chinook salmon associated with the actions proposed to occur in the mainstem rivers and tributaries in the UCR region and/or the Columbia River migration corridor is **0.001 percent (23/1,843,938)**. Percent mortality of juvenile, endangered, artificially-propagated, UCR spring chinook salmon associated with the actions proposed to occur in the mainstem rivers and tributaries in the UCR region and/or the Columbia River migration corridor is **0.027 percent (119/438,210)**. Based on the foregoing analysis, NMFS concludes that the annual non-lethal take of up to 76 juvenile, endangered, naturally-produced, UCR spring chinook salmon and up to 2,497 juvenile, endangered, artificially-propagated, UCR spring chinook salmon that is proposed to occur in the mainstem rivers and tributaries in the UCR region and/or the Columbia River migration corridor, together with the annual lethal take of up to 23 juvenile, endangered, naturally-produced, UCR spring chinook salmon and up to 119 juvenile, endangered, artificially-propagated, UCR spring chinook salmon, will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Adequate measures are in place to minimize the effects of the non-lethal take.

<u>UCR Steelhead Adults</u>
There are two proposed permit actions that involve take of adult, endangered, UCR steelhead (1345 and 1386). The take levels associated with those permit actions are summarized below:

UCR Steelhead Adults

Proposed Permit Action	Non-lethal Take of UCR Steelhead Adults	Lethal Take of UCR Steelhead Adults
1345	1	0
1386	20	0
Totals	**21**	**0**

The total annual non-lethal take of adult, endangered, UCR steelhead associated with the proposed actions will occur in the mainstem rivers and tributaries in the UCR Basin and/or the mainstem Columbia River migration corridor. The researchers will not be able to distinguish between the different populations of UCR steelhead when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed actions on specific populations of UCR steelhead. Because of the uncertainty, this analysis is not sensitive enough to evaluate the effects at the population level. Therefore, this analysis assumes that the status of each affected population of UCR steelhead is the same as the ESU as a whole.

For the purpose of this analysis, the total annual non-lethal take of adult, endangered, UCR steelhead associated with the proposed actions is compared with a recent five-year average for the species' annual escapement for the ESU as a whole. Adult escapement numbers at Rock Island Dam are used for this analysis since the majority of the species' tributaries of origin are upstream of this dam. According to the Fish Passage Center, the most recent five-year average for the annual adult escapement of UCR steelhead to Rock Island Dam (1997-2001) is 11,633 (FPC 2002). These fish represented a combination of naturally-produced adults and adults that originated from the hatchery supplementation programs in the upper Columbia River region overseen by WDFW. No mortalities of adult, endangered, UCR steelhead are expected. If the five-year average for the annual adult escapement of UCR steelhead to Rock Island Dam is assumed to be typical for future years, NMFS does not believe that the annual non-lethal take of up to 21 adult, endangered, UCR steelhead associated with the proposed actions will impact the viability of the steelhead populations that originate in the UCR region.

Percent mortality of adult, endangered, UCR steelhead associated with the proposed actions is **0.00 percent (0/11,633)**. Based on the foregoing analysis, NMFS concludes that the annual non-lethal take of up to 21 adult, endangered, UCR steelhead that is proposed to occur in the mainstem rivers and tributaries in the UCR region and/or the Columbia River migration corridor will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Adequate measures are in place to minimize the effects of the non-lethal take.

UCR Steelhead Juveniles

Tributary Areas

There is only one proposed permit action that involves an annual take of juvenile, endangered, UCR steelhead in the tributary areas within the species' ESU. That permit action is the proposed amendment of USFS's scientific research Permit 1335. Since there is only one permit action that involves an annual take of endangered UCR steelhead juveniles in the tributary areas within the species' ESU, the analysis of the effects of that take is sufficient at the individual permit action level (see the *Permit-Specific Effects* section above).

Mainstem Rivers and Tributaries

The following table summarizes the total annual non-lethal take that has the potential to result in lethal take (capture, handle, release) and the total annual lethal take of juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with the proposed actions that will occur in the mainstem rivers and tributaries in the UCR region and/or the Columbia River migration corridor. Lethal take in the table includes both proposed direct mortalities and proposed indirect mortalities where applicable.

UCR Steelhead Juveniles - Mainstem Rivers and Tributaries

Proposed Permit Action	Non-lethal Take of Naturally-Spawned UCR Steelhead Juveniles	Mortality of Naturally-Spawned UCR Steelhead Juveniles	Non-lethal Take of Artificially-Propagated UCR Steelhead Juveniles	Mortality of Artificially-Propagated UCR Steelhead Juveniles	Total Mortalities
1345-Amd	2	0	1	0	0
1366-New	0	93	35	19	112
1386-New	50	1	50	1	2
Totals	**52**	**94**	**86**	**20**	**114**

The total annual non-lethal and lethal takes of juvenile, endangered, naturally-produced and artificially-propagated, UCR steelhead associated with the proposed actions will occur in the mainstem rivers and tributaries in the UCR region and/or the mainstem Columbia River migration corridor. The researchers will not be able to distinguish between the different populations of UCR steelhead when working outside of the tributary watersheds from which the fish originate. As such, there is extensive uncertainty in trying to determine the impact of the proposed actions on specific populations of UCR steelhead. Because of the uncertainty, this analysis is not sensitive enough to evaluate the effects at the population level. Therefore, this analysis assumes that the status of each affected population of UCR steelhead is the same as the ESU as a whole.

For the purpose of this analysis, the total annual mortality level of UCR steelhead juveniles is compared with the 2002 juvenile steelhead outmigration estimates at Rock Island Dam since the majority of the species' tributaries of origin are upstream of this dam. According to the juvenile steelhead outmigration estimates produced by NMFS' NWFSC for the 2002 outmigration season (Schiewe 2002), the total number of naturally-produced, UCR steelhead juveniles expected to reach Rock Island Dam in 2002 under the transportation with spill scenario will be 218,400 and the total number of artificially-propagated, UCR steelhead juveniles expected to reach Rock Island Dam in 2002 under the transportation with spill scenario will be 738,082. If the estimated production for the 2002 juvenile steelhead outmigration season is assumed to be typical for future years, NMFS does not believe that the total annual lethal take of up to 94 juvenile, endangered, naturally-produced, UCR steelhead and up to 20 juvenile, endangered, artificially-propagated, UCR steelhead associated with the proposed actions will impact the viability of the steelhead populations that originate upstream of Rock Island Dam.

Percent mortality of juvenile, endangered, naturally-produced, UCR steelhead associated with the actions proposed to occur in the mainstem rivers and tributaries in the UCR region and/or the Columbia River migration corridor is **0.043 percent (94/218,400)**. Percent mortality of juvenile, endangered, artificially-propagated, UCR steelhead associated with the actions proposed to occur in the mainstem rivers and tributaries in the UCR region and/or the Columbia River migration corridor is **0.003 percent (20/738,082)**. Based on the foregoing analysis, NMFS concludes that the annual non-lethal take of up to 52 juvenile, endangered, naturally-produced, UCR steelhead and up to 86 juvenile, endangered, artificially-propagated, UCR steelhead that is proposed to occur in the mainstem rivers and tributaries in the UCR region and/or the migration corridor, together with the annual lethal take of up to 94 juvenile, endangered, naturally-produced, UCR steelhead and up to 20 juvenile, endangered, artificially-propagated, UCR steelhead, will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Adequate measures are in place to minimize the effects of the non-lethal take.

CUMULATIVE EFFECTS

Cumulative effects are those effects of future Tribal, state, local or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. For the purpose of this analysis, the action area is that part of the UCR Basin described in the *Description of the Proposed Actions* section above. Future Federal actions, including the operation of hydropower systems, hatcheries, fisheries, and land management activities will be reviewed through separate section 7 consultation processes. Non-Federal actions that require authorization under section 10 of the ESA, and that are not included within the scope of this consultation, will be evaluated in separate consultations.

Future Tribal, state, and local government actions will likely to be in the form of legislation, administrative rules or policy initiatives. Government and private actions may include changes in land and water uses, including ownership and intensity, any of which could impact ESA-listed species or their habitat. Government actions are subject to political, legislative, and fiscal uncertainties. These realities, added to geographic scope of the action area which encompasses numerous government entities exercising various authorities and the many private landholdings, make any analysis of cumulative effects difficult and frankly speculative. This section identifies representative actions that, based on currently available information, are reasonably certain to occur. It also identifies some goals, objectives, and proposed plans by government entities, however, NMFS is unable to determine at this point in time whether any proposals will in fact result in specific actions.

State Actions

Each state in the Columbia River Basin administers the allocation of water resources within its borders. Most streams in the basin are overappropriated even though water resource development has slowed in recent years. Washington closed the mainstem Columbia River to new water withdrawals, and is funding a program to lease or buy water rights. If carried out over the long term this might improve water quantity. The state governments are cooperating with each other and other governments to increase environmental protections, including better habitat restoration, hatchery, and harvest reforms. NMFS also cooperates with the state water resource management agencies in assessing water resource needs in the basin, and in developing flow requirements that will benefit ESA-listed fish. During years of low water, however, there could be insufficient flow to meet the needs of the fish. These government efforts could be discontinued or even reduced, so their cumulative effects on ESA-listed fish is unpredictable.

The state of Washington has various strategies and programs designed to improve the habitat of ESA-listed species and assist in recovery planning, including the Salmon Recovery Planning Act, a framework for developing watershed restoration projects. The state is developing a water quality improvement scheme through the development of TMDLs (total maximum daily loads). As with the Oregon initiatives, these programs could benefit the ESA-listed species if implemented and sustained.

In the past, each state's economy was heavily dependent on natural resources, with intense resource extraction activity. Changes in the states' economies have occurred in the last decade and are likely to continue with less large scale resource extraction, more targeted extraction methods, and significant growth in other economic sectors. Growth in new businesses is creating urbanization pressures with increased demands for buildable land, electricity, water supplies, waste disposal sites, and other infrastructure. Economic diversification has contributed to population growth and movement in the states, a trend likely to continue for the next few decades. Such population trends will place greater demands in the action area for electricity, water, and buildable land; will affect water quality directly and indirectly; and will increase the need for transportation, communication, and other infrastructure development. The impacts associated with economic and population demands will affect habitat features, such as water quality and quantity, which are important to the survival and recovery of the ESA-listed species. The overall effect is likely to be negative, unless carefully planned for and mitigated.

Some of the state programs described above are designed to address these impacts. Also, Washington enacted a Growth Management Act to help communities plan for growth and address growth impacts on the natural environment. If the programs continue they may help lessen some of the potential adverse effects identified above.

Local Actions

Local governments will be faced with similar but more direct pressures from population growth and movement. There will be demands for intensified development in rural areas as well as increased demands for water, municipal infrastructure, and other resources. The reaction of local governments to such pressures is difficult to assess at this time without certainty in policy and funding. In the past, local governments in the action area generally accommodated additional growth in ways that adversely affected ESA-listed fish habitat. Also there is little consistency among local governments in dealing with land use and environmental issues so that any positive effects from local government actions on ESA-listed species and their habitat are likely to be scattered throughout the action area.

In Washington, local governments are considering ordinances to address aquatic and fish habitat health impacts from different land uses. These programs are part of state planning structures. Some local government programs, if submitted, may qualify for a limit under the NMFS' ESA section 4(d) rule which is designed to conserve ESA-listed species. Local governments also may participate in regional watershed health programs, although political will and funding will determine participation and therefore the effect of such actions on ESA-listed species. Overall, without comprehensive and cohesive beneficial programs and the sustained application of such programs, it is likely that local actions will not have measurable positive effects on ESA-listed species and their habitat, but may even contribute to further degradation.

Tribal Actions

Tribal governments will continue to participate in cooperative efforts involving watershed and basin planning designed to improve fish habitat. The results from changes in Tribal forest and agriculture practices, in water resource allocations, and in changes to land uses are difficult to assess for the same reasons discussed under State and Local Actions. The earlier discussions related to growth impacts apply also to Tribal government actions. Tribal governments will need to apply comprehensive and beneficial natural resource programs to areas under their jurisdiction to produce measurable positive effects for ESA-listed species and their habitat.

Private Actions

The effects of private actions are the most uncertain. Private landowners may convert current use of their lands, or they may intensify or diminish current uses. Individual landowners may voluntarily initiate actions to improve environmental conditions, or they may abandon or resist any improvement efforts. Their actions may be compelled by new laws, or may result from growth and economic pressures. Changes in ownership patterns will have unknown impacts. Whether any of these private actions will occur is highly unpredictable, and the effects even more so.

<u>Summary</u>
Non-federal actions are likely to continue affecting the ESA-listed species. The cumulative effects in the action area are difficult to analyze considering the geographic landscape of this opinion, the political variation in the action area, the uncertainties associated with government and private actions, and the changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to increase. Although state, Tribal, and local governments have developed plans and initiatives to benefit ESA-listed fish, they must be applied and sustained in a comprehensive way before NMFS can consider them “reasonably foreseeable” in its analysis of cumulative effects.

CONCLUSIONS

After reviewing the current status of the endangered species that are the subject of this consultation, the environmental baselines for the action areas, the effects of the proposed section 10(a)(1)(A) permit actions, and cumulative effects, it is NMFS’ biological opinion that issuance of the permit actions, as proposed, and the funding of the proposed activities by Federal agencies, if applicable, are not likely to jeopardize the continued existence of endangered UCR spring chinook salmon or endangered UCR steelhead or result in the destruction or adverse modification of the species’ respective habitats.

INCIDENTAL TAKE STATEMENT

Section 9 and the regulations implementing section 4 of the ESA prohibit any take (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of ESA-listed species without a specific permit or exemption. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to ESA-listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

However, as discussed in the accompanying biological opinion, the proposed takes of ESA-listed species is part of the intended purpose of the proposed actions and is, therefore, not incidental take. Therefore, NMFS does not expect that implementation of the proposed actions will incidentally take threatened or endangered species.

CONSERVATION RECOMMENDATIONS

Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to develop additional information, or to assist Federal agencies in complying with their obligations under section 7(a)(1) of the ESA. NMFS believes the following conservation recommendation is consistent with these obligations, and therefore should be implemented:

> NMFS shall monitor actual annual takes of ESA-listed fish species associated with scientific research activities, as provided to NMFS in annual reports or by other means, and shall adjust annual permitted take levels if they are deemed to be excessive or if cumulative take levels are determined to operate to the disadvantage of the ESA-listed species.

REINITIATION OF CONSULTATION

Consultation must be reinitiated if: The amount or extent of cumulative annual takes specified in the permits and/or the Incidental Take Statement of this consultation is exceeded or is expected to be exceeded; new information reveals effects of the actions that may affect the ESA-listed species in a way not previously considered; a specific action is modified in a way that causes an effect on the ESA-listed species that was not previously considered; or a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

"Essential fish habitat" (EFH) is defined in section 3 of the Magnuson-Stevens Act (MSA) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS interprets EFH to include aquatic areas and their associated physical, chemical, and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The MSA and its implementing regulations at 50 CFR 600.920 require a Federal agency to consult with NMFS before it authorizes, funds, or carries out any action that may adversely effect EFH. The purpose of consultation is to develop a conservation recommendation(s) that addresses all reasonably foreseeable adverse effects to EFH. Further, the action agency must provide a detailed, written response to NMFS within 30 days of receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with NMFS' conservation recommendation the agency must explain its reasons for not following the recommendation.

Thus, one of the objectives of this consultation is to determine whether the proposed actions—the issuance of scientific research permits under section 10(a)(1)(A) of the ESA for activities in Washington State—are likely to adversely affect EFH. If the proposed actions are likely to adversely affect EFH, conservation recommendations will be provided.

Identification of Essential Fish Habitat

The Pacific Fishery Management Council (PFMC) is one of eight Regional Fishery Management Councils established under the Magnuson-Stevens Act. The PFMC develops and carries out fisheries management plans for Pacific coast groundfish, coastal pelagic species, and salmon off the coasts of Washington, Oregon and California. Pursuant to the MSA, the PFMC has designated freshwater and marine EFH for chinook and coho salmon (PFMC 1999). For the purpose of this consultation, freshwater EFH for salmon in Washington includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to Pacific salmon, except upstream of the impassable dams. In the future, should subsequent analyses determine the habitat above any impassable dam is necessary for salmon conservation, the PFMC will modify the identification of Pacific salmon EFH (PFMC 1999). Marine EFH for Pacific salmon in Oregon and Washington includes all estuarine, nearshore, and marine waters within the western boundary of the U.S. Exclusive Economic Zone (EEZ), 200 miles offshore.

Proposed Action and Action Area

For this EFH consultation, the proposed actions and action area are as described in detail above. The actions are the issuance of a number of scientific research permits pursuant to section 10(a)(1)(A) of the ESA. The proposed action area is the upper Columbia River Basin, including all river reaches accessible to salmon in Columbia River tributaries upstream to Chief Joseph Dam in Washington. A more detailed description and identification of EFH for salmon is found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the impacts on these species' EFH from the above proposed actions are based on this information.

Effects of the Proposed Actions

Based on information submitted by the action agencies and permit applicants, as well as NMFS' analysis in the ESA consultation above, NMFS believes that the effects of the proposed actions on EFH are likely to be within the range of effects considered in the ESA portion of this consultation.

Conclusion

Using the best scientific information available, and based on the ESA consultation above, as well as the foregoing EFH sections, NMFS has determined that the proposed actions are not likely to adversely affect EFH for Pacific salmon.

EFH Conservation Recommendations

The Reasonable and Prudent Measures and the Terms and Conditions outlined in the ESA consultation above, if any, are applicable to designated salmon EFH. Therefore, NMFS recommends that those same Reasonable and Prudent Measures and Terms and Conditions be adopted as the EFH Conservation Recommendations for this consultation.

Statutory Response Requirement

Section 305(b)(4)(B) of the MSA and implementing regulations at 50 CFR section 600.920 require a Federal action agency to provide a detailed, written response to NMFS within 30 days after receiving an EFH conservation recommendation. The response must include a description of measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with a conservation recommendation from NMFS, the agency must explain its reasons for not following the recommendation.

Consultation Renewal

The action agencies must reinitiate EFH consultation if plans for the actions are substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for the EFH conservation recommendations (50 CFR Section 600.920(k)).

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